

# Closeout Report for The Source Removal of Polychlorinated Biphenyls

RF/RMRS-97-044 Rev. 0



July 1997

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#### LIST OF ACRONYMS

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act

CDPHE Colorado Department of Public Health and Environment

CFR Code of Federal Regulations
DOE U.S. Department of Energy

EPA U.S. Environmental Protection Agency

HRR Historical Release Report HSP Health and Safety Plan

IHSS Individual Hazardous Substance Site

MRI Midwest Research Institute

NFA No Further Action
OU Operable Unit

PAC Potential Area of Concern PAM Proposed Action Memorandum

PCB Polychlorinated Biphenyl

ppb parts per billion

PPE Personal Protective Equipment

ppm parts per million

RFCA Rocky Flats Cleanup Agreement

RFETS Rocky Flats Environmental Technology Site RMRS Rocky Mountain Remediation Services, L.L.C.

ROD Record of Decision

SAP Sampling and Analysis Plan TSCA Toxic Substance Control Act

U not detected

ug/kg micrograms per kilogram

yd<sup>3</sup> Cubic Yards

# **DEFINITIONS**

Aroclor A common tradename for PCB dielectric oil used in transformers.

Aroclor 1254 means that a biphenyl molecule (two chlorine atoms surrounded by 12 carbon atoms) is chlorinated at a 54% ratio by

weight.

Certificate of Disposal A Certificate of Disposal is a document generated by the disposer

of PCB waste for PCBs and/or PCB Items disposed of at the

facility.

Chemical Waste Landfill A landfill at which protection against risk of injury to human

health or the environment from migration of PCBs to land, water, or the atmosphere is provided from PCBs and PCB items deposited therein by locating, engineering, and operating the landfill as

specified in 40 CFR 761.75.

Destructive Samples Collection of physical samples usually on porous surfaces using

an impact drill or other means.

Draft EPA Method 4020 A field screening method used to acquire cost effective in situ data

(Immunoassay) to determine areal extent and vertical migration of PCBs. This method may also be used to verify decontamination is

appropriate.

EPA Method 8080 An EPA approved method for laboratory analysis of PCBs

commonly used to verify final cleanup standards were met.

Hydrohammer A heavy duty pneumatic "jack hammer like" attachment usually

fitted to a backhoe or excavator for breaking rock or concrete.

Kettleman, California A selected Chemical Waste Landfill for this PCB removal project.

Outdoor Electrical Outdoor, fenced, and restricted access area used in the Substation

transmission and/or distribution of electrical power as defined

under 40 CFR 761.30(1)(1)(ii).

PCB(s) Polychlorinated biphenyl(s) are chemical substances consisting of

the biphenyl molecule which has been chlorinated to varying degrees. PCBs are often associated with other chlorinated

hydrocarbon compounds such as Furans and Dioxins.

Restricted Access Area

A location limited by natural or manmade barriers at least 0.1 kilometers from residential or commercial areas. PCB spills or releases occurring in a Restricted Access Area must be cleaned up to 25 ppm PCBs by weight for soil and 100ug/100cm<sup>2</sup> for all other solid surfaces per 40 CFR 761.125.

**TSCA** 

The Toxic Substance Control Act (TSCA) was passed by Congress in 1976 and was designed primarily as a vehicle in which chemicals could be evaluated before use thereby reducing risk to human health, other organisms and the environment.

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#### 1.0 Introduction

This completion report describes the Polychlorinated Biphenyl (PCB) Removal Project, including the site histories, remediation activities, and the disposition of the waste. The removal activities began in the fall of 1995 and concluded in late summer of 1996. All removal activities were conducted in accordance with the *Final Proposed Action Memorandum* (PAM), *Remediation of PCBs* (DOE 1995), *Final Sampling and Analysis Plan* (SAP) (RMRS 1995a), and *Final Project-Specific Health and Safety Plan/PCB Removal Project* (RMRS 1995b).

The remediation of PCBs was initiated with the discovery of PCB-contaminated soil in July of 1991. Specific sites (hereafter referred to as PCB sites) were identified through a site-wide assessment (EG&G 1991), assigned a unique identification number (i.e., PCB Site 1), and incorporated into the *Historical Release Report* (HRR) (DOE 1992) as Potential Areas of Concern (PACs). Of those identified in the HRR, twelve required additional evaluation because of suspected PCB levels in excess of the 25 parts per million (total) Toxic Substances Control Act (TSCA) guidance for Restricted Access Areas at outdoor electrical substations. The investigation and subsequent remediation was performed in accordance with Section I.B.10 of the Interagency Agreement (IAG) (DOE 1991) which provides a mechanism to expedite a Risk Reduction/Source Removal Action utilizing an approved PAM. The Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) concurred with this approach and approved the 25 ppm guidance level for PCB contamination at the Rocky Flats Environmental Technology Site (RFETS).

Remediation of 11 of the 12 PACs was successful in obtaining closure criteria as demonstrated by post-removal verification results below the 25 ppm standard. The Annual Update for the Historical Release Report (DOE 1996b) submitted to the Department of Energy (DOE), EPA and CDPHE in accordance with the Final Rocky Flats Cleanup Agreement (RFCA) (DOE 1996a) proposed No Further Action (NFA) status for these 11 PACs. These sites will be officially closed under the Industrial Area Operable Unit (OU) Record of Decision (ROD). The ROD will also address the PAC (PAC-1102/PCB-21) at which residual concentrations above the 25 ppm standard remain. The validation results will be evaluated for data usability as part of the quality control for the project and submitted as an addendum to this report.

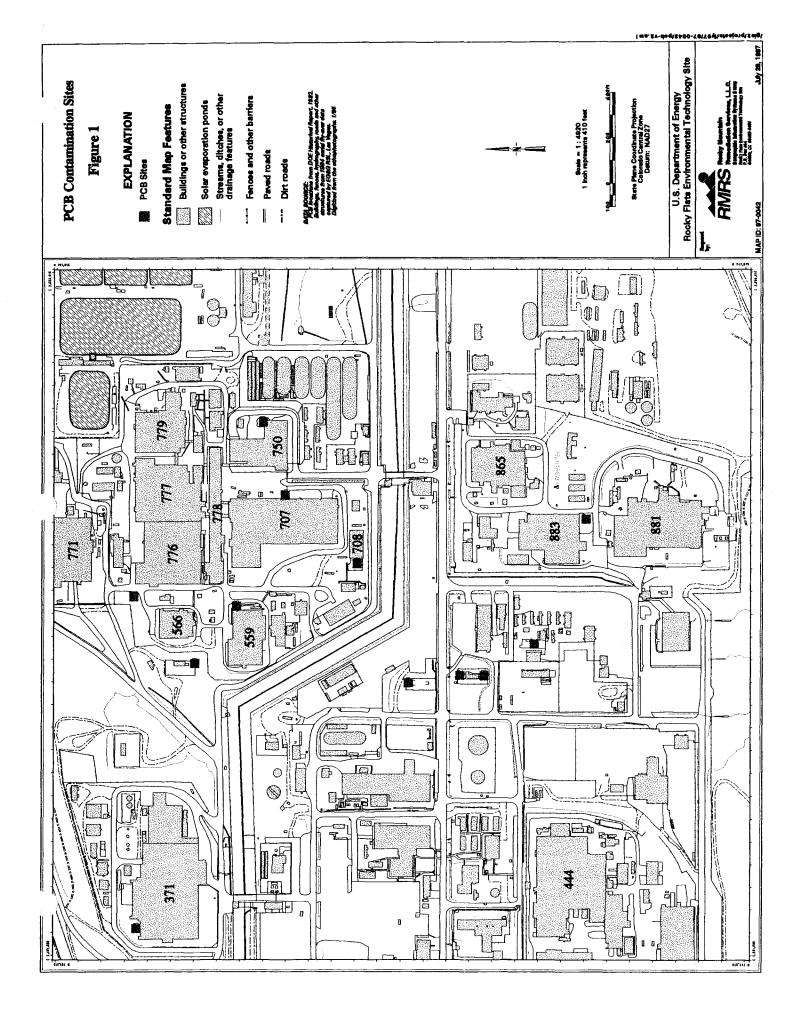
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# 2.0 Background and Pre-remediation Activities

A sitewide program was initiated in 1991 to identify known, suspect, and potential PCB contaminated sites at RFETS. The study, documented in Assessment of Potential Environmental Releases of PCBs Preliminary Assessment/Site Description, (EG&G 1991) consisted of document and record reviews, personnel interviews, and field sampling and analysis at 37 locations. These suspect locations became known as PCB sites 1-37. Based on the results presented in the assessment (EG&G 1991), the following sites were targeted for expedited action in accordance with Section I.B.10 of the Rocky Flats Interagency Agreement (IAG) (DOE 1991) as documented in the Final PAM, Remediation of PCBs (DOE 1995). The locations, identified by PCB site number, are illustrated on the site map which follows.

To delineate the lateral and vertical extent of PCB contamination at these sites, surficial and subsurface soil samples were collected and analyzed in the field using an immunoassay technique, Draft Method 4020. Additionally, if concrete was present within a given PCB site, then the area of the site was calculated and statistically gridded so that destructive concrete samples could be collected and analyzed using EPA Method 8080. Grid squares were assigned a number and samples were collected based upon random number generation. In several cases, the collection points fell within an unattainable area (such as under a transformer) and the sampling grid had to be re-run.

Table 2-1 provides a cross-reference between PCB TSCA site numbers as identified in the original PCB assessment (EG&G 1991) and its respective PAC number as presented in the HRR (DOE 1992). In addition, pre-remediation PCB concentrations for the soil and concrete samples are provided with the closest adjacent building for site reference.



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Table 2-1. Pre-Remediation Soil and Concrete Levels

HRR PAC#	TSCA Loc. Code	Building Number	Sample Number	Matrix <sup>1</sup>	Aroclor 1242 (ppm)	Aroclor 1248 (ppm)	Aroclor 1254 (ppm)	Aroclor 1260 (ppm)
500-905	PCB-10	555/558	SS00385ST	SOIL	U	U	U	480.0
500-905	PCB-10	555/558	CT00028EG	CONCRETE	U	U	U	0.4
600-1003	PCB- 12/13	661/675	SS00376ST	SOIL	U	U	U	540.0
600-1003	PCB-13	661/675	CT00039RM	CONCRETE	U	U	U	0.1
800-1207	PCB-17	883	SS00470ST	SOIL	U	160.0	U	U
800-1207	PCB-17	883	CT00016EG	CONCRETE	U	2.5	1.0	0.1
500-900	PCB-20	515/516	SS00625ST	SOIL	U	U	U	26.0
500-900	PCB-20	515/516	CT00036EG	CONCRETE	0.9	U	U	0.9
700-1102	PCB-21	776	SS00503ST	SOIL	U	U	U	480.0
700-1102	PCB-21	776	CT00003EG	CONCRETE	U	U	U	56.0
500-902	PCB-23	559	SS00385ST	SOIL	U	190.0	U	U
500-902	PCB-23	559	CT00004EG	CONCRETE	U	U	U	0.04
700-1104	PCB-24	708	SS00583ST	SOIL	U	U	860.0	U
700-1104	PCB-24	708	CT00008EG	CONCRETE	U	U	U	U
700-1103	PCB-25 <sup>2</sup>	707	SS00325ST	SOIL	U	U	1600.0	U
700-1111	PCB-26	750	SS00513ST	SOIL	U	160.0	U	U
700-1111	PCB-26	750	CT00011EG	CONCRETE	U	U	U	U
300-708 <sup>3</sup>	PCB-33	371	SS00606ST	SOIL	U	U	U	>50
300-708	PCB-33	371	CT00030EG	CONCRETE	1.3	Ū	U	U
600-1000	PCB-37	662	G03484	SOIL	U	73.0	U	86.0
600-1000	PCB-37	662	SS00569RM	CONCRETE	U	U	0.2	1.2

<sup>&</sup>lt;sup>1</sup> Maximum Concentration
<sup>2</sup> PCB site 25 did not have any concrete to analyze

<sup>&</sup>lt;sup>3</sup>Chlorinsoil® data indicated >50 ppm (EG&G 1991)

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#### 3.0 Remediation Activities

The Final PAM, Remediation of PCBs (DOE 1995) guided the remediation of approximately 500 cubic yards of soil and concrete from 12 PCB sites. All activities were conducted in accordance with the PAM and Final Project-Specific Health and Safety Plan/PCB Removal Project (RMRS 1995b). Verification sampling included a combination of field screening using Draft Method 4020 and confirmational split samples analyzed using SW-846 Method 8080 as specified in the Final Sampling and Analysis Plan (SAP) (RMRS 1995a). To assure that the 25 ppm TSCA guidance level was achieved during cleanup, a target remediation goal of 10 ppm (total) PCBs, or less, using the Method 4020 field screening analysis was prescribed for the removal.

Remediation began in the fall of 1995 and was completed in late summer of 1996. Excavated material with PCB concentrations exceeding the 25 ppm standard were disposed off-site at an EPA-approved disposal facility. Concrete transformer pads were broken with a hydrohammer and subsequently removed using backhoes, excavators, front-end loaders and hand shovels. Concrete with PCB concentrations less than the 25 ppm was disposed at the RFETS landfill. Soil was removed in a similar manner, in one foot lifts. Details of the excavation activities for each PCB site are included in Section 3.1.

As the remediation progressed, verification samples were collected using the EPA Midwest Research Institute (MRI) grid methodology (Appendix C). Field screening analysis of samples collected from this grid was performed in an on-site (mobile) laboratory using the immunoassay technique prescribed in SW-846, Draft Method 4020. Excavation activities proceeded in 1 foot lifts (i.e., additional soil was excavated) until the immunoassay results indicated that the total PCB concentration was near, or below, the 10 ppm remediation goal. One exception is noted. At PCB site PCB-37, 6 of the immunoassay results exceeded the 10 ppm remediation goal, but re-analysis using a 25 ppm calibration standard and analysis from split samples using Method 8080 verify that the soil was below the 25 ppm guidance level.

Twenty percent of the samples for each verification grid were split and analyzed using SW-846 Method 8080 to confirm the accuracy of the field screening method. In addition, for every twenty samples, one duplicate was collected and analyzed using the same method. All samples were collected using clean and/or decontaminated sampling equipment (i.e., spoons/scoops). At a minimum, one equipment smear sample was collected daily and/or between sites and analyzed using the 4020 immunoassay technique to assess cross-contamination and positive bias (i.e., false positive) potential. The final MRI grid of verification samples was considered as the confirmation grid for that site (see Appendix A). Split samples were then shipped off-site for SW-846 Method 8080 analysis to provide cleanup verification (see Appendix B). Table 3-1 shows post-removal split sample results confirming that all of the sites, with the exception of PCB-21, were remediated to less than 25 ppm PCBs by weight and, in most cases, substantially lower. Table 3-2 provides a comprehensive data summary of Method 8080 soil and concrete samples on a site-

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by-site basis. The table also includes results from the Draft Method 4020 immunoassay field screening analysis, confirmational splits, and Method 8080 analysis of clean fill material obtained off-site. Excavations were backfilled with PCB-free structural material (<1 ppm PCBs by weight) obtained from an off-site source and the sites were reclaimed to, at a minimum, their original condition.

# 3.1 Brief Description of Remediation Activities by Each Site

# PCB-10 (555/558 Substation):

Approximately 4.3 yd<sup>3</sup> of soil were removed from the northwest corner of the 555/558 substation using shovels during the first week of September 1995. The PCB-10 site was confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-12/13 (661/675 Substation):

Approximately 46.7 yd<sup>3</sup> of soil were removed from around the substation using hand shovels during the second and third week of February 1996. The PCB-12 & 13 sites were confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-17 (Southeast Corner of Building 883):

Approximately 22.1 yd³ of soil, 2 yd³ of asphalt and 8.5 yd³ of concrete were removed from the southeast corner of Building 883 using backhoes, front-end loaders, a hydrohammer, and shovels during the second week of September 1995. The PCB-17 site was confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-20 (515/516 Substation):

Approximately 5.8 yd<sup>3</sup> of soil were removed from the south side of the 515/516 Substation using a backhoe, a bobcat and hand shovels in late August 1995. The contaminated soil was located immediately east of the 516 transformer. The PCB-20 site was confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-21 (Northwest Corner of Building 776)

Approximately 177 yd<sup>3</sup> of soil and 10.7 yd<sup>3</sup> of concrete were removed from the northwest corner of Building 776 with backhoes, front-end loaders, excavators, a hydrohammer, and hand shovels

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between October 2, 1995 and June 24, 1996. Numerous removal events (i.e., re-excavations) to a total depth of approximately 17 feet were required in the attempt to achieve the cleanup guidance level of 25 ppm (total PCBs). The guidance level was not achieved; however, the site was cleaned from an initial PCB contaminant level of 480 ppm in the soil and 56 ppm on the concrete pad to 70 ppm PCBs in soil at a single location and at a 17 foot depth. The excavation activity was stopped due to equipment limitations and health and safety concerns as documented in the Final Annual Update to the Historical Release Report (HRR) transmitted to the EPA and CDPHE on September 30, 1996. An extensive survey was conducted of the excavation prior to backfilling with structural grade fill. No available information could be found explaining contaminant levels at such depth, however, the diligent effort significantly reduced risk to human health and the environment.

# PCB-23 (East of Building 559):

Approximately 27.2 yd<sup>3</sup> of soil were removed from the northeast corner of Building 559 using a backhoe, a hydrohammer, front-end loaders, a bobcat and hand shovels during the last several weeks of September 1995. The PCB-23 site was confirmed at <10 ppm PCBs by weight using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-24 (West of Building 708):

Approximately 24.1 yd<sup>3</sup> of soil and 1.5 yd<sup>3</sup> of concrete were removed from the west side of Building 708 using backhoes, front-end loaders, a hydrohammer, a bobcat, concrete saw, and hand shovels in early October 1995. The PCB-24 site was confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

#### PCB-25 (East Side of Building 707):

In 1991, one of the six transformers located on the rooftop of Building 707 was identified as leaking PCB dielectric oil. Further investigation revealed that rain water had carried PCBs, via a downspout, from the contaminated rooftop to the soil below. An extensive PCB cleanup was initiated in 1991 and 1992 under TSCA regulations and the roof was declared clean. The contaminated soil area below was cordoned off and marked "PCB Contaminated Area" until appropriate actions could be taken under CERCLA. Approximately 64.8 yd<sup>3</sup> of soil were removed from an area immediately south of the main entrance doorway of Building 707 (east side) using backhoes, front-end loaders, excavators, bobcats and hand shovels during the second half of September 1995. The PCB-25 site was confirmed at <10 ppm PCBs by weight using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

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# PCB-26 (East of Building 750):

Approximately 12.1 yd<sup>3</sup> of soil and 8.0 yd<sup>3</sup> of concrete were removed from the old transformer location on the east side of Building 750 using backhoes, front-end loaders, a hydrohammer, a bobcat and hand shovels in late September 1995. The PCB-26 site was confirmed at <10 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

# PCB-33 (North of Building 371):

Approximately 1.08 yd<sup>3</sup> of soil were removed immediately north of Transformer 371-2 using hand shovels in late August 1995. Destructive concrete verification sampling show no other PCB contamination. The PCB-33 site was confirmed at <10 ppm PCBs by weight in the soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

#### PCB-37 (East of Building 662):

Approximately 85.1 yd<sup>3</sup> of soil were removed from the east side of Building 662 using backhoes, front-end loaders, bobcats and hand shovels during the month of July 1996. Method 8080 analysis of destructive concrete samples collected verify that all concrete areas were clean. The PCB-37 site was confirmed at <25 ppm PCBs by weight in soil using EPA Method 8080. The confirmation of remediation of soils at this site provide the basis for NFA status.

#### 3.2 Quality Control Samples

Duplicate, split, smear, and method blank samples were collected in accordance with the *Final SAP* (RMRS 1995a). The results for these samples as indicators of the quality of the sampling and analysis in support of remediation activities is discussed for each of these sample type. The quality assurance/quality control samples will be further evaluated with the validated data for usability with respect to precision, accuracy, representativeness, comparability, and completeness and submitted as an addendum to this report.

As indicated in Table 3-2, duplicates were collected at a minimum of 1 per site or at an approximate frequency of 1 for every 10 samples. The duplicates were analyzed by Draft Method 4020 as an indicator of the precision of the measurement. A comparison of the duplicate results indicate that method produced precise (i.e., reproducible) measurements.

Split samples were collected and analyzed by Method 8080 to confirm the measurements obtained from the Draft Method 4040 results. The 86 split samples are identified in column four of Table 3-2, Method 8080 Soil Results. Comparison of the Method 8080 results with the Draft Method

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4020 results indicate that the Draft Method adequately represent the concentrations at the remediation sites with only one exception. Out of the 86 split samples analyzed, sample SS00206RM showed an inconsistency between the two methods with a 12 ppm concentration detected via Method 8080 and a less than 10 ppm observation made using Draft Method 4020. PCB Site 25 is the only site affected by this inconsistency. As indicated on Table 3-2, five other split samples collected at PCB Site 25 indicate levels well below the 10 ppm target remediation goal and the 25 ppm guidance level.

Smear samples were collected by wiping the sampling equipment with a 10 by 10 centimeter wipe saturated with methanol. The smear sample results are an indication of cross-contamination and the potential for positive bias in the sample results. A total of 72 smear samples were collected. Of the 72 smears, 2 samples showed a positive result (i.e., greater than 10 ppm). A positive result for a smear sample could indicate that the concentrations in the samples associated with the smear were potentially positively biased. The effect of positive bias on the samples is a potential false positive result. The site associated with the two smear samples is PCB Site 37. As indicated on Table 3-2, the site was remediated until levels below the 25 ppm were achieved. As a result, the effect of the positive bias is considered negligible.

For all data reported, none of the method blanks analyzed by Draft Method 4020 had positive detections. A total of 79 method blank samples to assess the potential for positive bias in the sample results. The method blank samples were analyzed by Draft Method 4020. Of the 79 method blank results, 77 were negative (i.e., less than 10 ppm). Two of the method blank samples indicated positive (i.e., greater than 10 ppm) results. A positive result for a method blank could indicate that the concentrations in the samples were potentially positively biased. The effect of positive bias on the samples is a potential false positive result. The site associated with the two method blank samples with positive results is PCB Site 21. As indicated on Table 3-2, the site was remediated until levels below 25 ppm were achieved. Therefore, the effect of the positive bias is considered negligible.

#### 3.3 Summary of Remediation Activities

The volume of soil and concrete excavated for each location is summarized in Section 4.0 and presented in Table 4-1. All of the remediation sites were confirmed to be less than 10 ppm PCBs by weight with the exception of site PCB-37 which is confirmed to be less than 25 ppm and site PCB-21 which was halted for safety reasons at approximately 17 feet. Contaminated soil and concrete was shipped to an EPA-approved, TSCA-licensed chemical waste landfill in Kettleman, California for final disposal. In most cases, concrete samples collected from the old transformer pads were well below the 25 ppm cleanup level, and soil contamination could be removed within an approximate 4 foot depth. All of the excavations were reclaimed to their original condition which included placement and compaction of structural grade fill material. The structural fill was sampled for PCBs using Method 8080 on two occasions (see Table 3-2, page 17).

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Table 3-1. PCB Post-Removal Levels in Soil<sup>1</sup>

Location Code	Location	Sample Number	Aroclor 1248 (ppm)	Aroclor 1254 (ppm)	Aroclor 1260 (ppm)
PCB-10	555/558	SS00033RM	U	U	1.3
PCB-12/13	661/675	SS00455RM	U	Ŭ	0.7
PCB-17	883	SS00090RM	3.1	U	U
PCB-20	515/516	SS00011RM	U	Ŭ	0.9
PCB-21	776	SS00533RM	U	Ŭ	70.0
PCB-23	559	SS00132RM	2.4	0.6	U
PCB-24	708	SS00301RM	Ŭ	3.2	Ū
PCB-25	707	SS00206RM	U	7.0	5.0
PCB-26	750	SS00162RM	5.9	U	U
PCB-33	371	SS00002RM	U	Ŭ	Ŭ
PCB-37 PCB-37	662 662	SS00569RM SS00616RM	1,2 U	U 2.5	3.1 0.6

<sup>1</sup>Maximum concentrations

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**Table 3-2.** Comprehensive Data Summary Method 8080 and 4020 Samples Collected Per Site.

	T	Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location	Numbers	(ppm)	(ppm)	(ppm)
PCB-10	CT00021EG	U	1	
PCB-10	CT00022EG	Ü	<del>                                     </del>	
PCB-10	CT00023EG	U	<del>                                     </del>	
PCB-10	CT00024EG	.04	<del>                                     </del>	
PCB-10	CT00025EG	U	†	
PCB-10	SS00021RM		<del>                                     </del>	<10
PCB-10	SS00022RM			<10
PCB-10	SS00024RM		<del>  </del>	<10
PCB-10	SS00025RM			<10
PCB-10	SS00026RM		.05	<10
PCB-10	SS00027RM			<10
PCB-10	SS00028RM		Ū	<10
PCB-10	SS00029RM		<del>                                     </del>	<10
PCB-10	SS00032RM		<del>                                     </del>	<10
PCB-10	SS00032RM		1.30	<10
PCB-10	SS00034RM(dup)		1	<10
			<del>                                     </del>	
PCB-12/13	CT00037RM	Ū	<del> </del>	
PCB-12/13	CT00038RM	U		
PCB-12/13	CT00039RM	.07	<del> </del>	
PCB-12/13	CT00040RM	U	<del></del>	
PCB-12/13	CT00041RM	Ü	<del>  -</del>	
PCB-12/13	CT00042RM	Ū		
PCB-12/13	CT00076RM	.08		
PCB-12/13	CT00081RM	U		
PCB-12/13	SS00426RM	<del></del>		<10
PCB-12/13	SS00427RM	•		<10
PCB-12/13	SS00428RM(dup)			<10
PCB-12/13	SS00429RM			<10
PCB-12/13	SS00430RM	<u> </u>	.12	<10
PCB-12/13	SS00431RM			<10
PCB-12/13	SS00432RM			<10
PCB-12/13	SS00433RM			<10
PCB-12/13	SS00434RM		.46	<10
PCB-12/13	SS00435RM			<10
PCB-12/13	SS00436RM			<10
PCB-12/13	SS00437RM		.44	<10
PCB-12/13	SS00438RM		.18	<10
PCB-12/13	SS00439RM			<10
PCB-12/13	SS00440RM			<10
PCB-12/13	SS00441RM		U	<10
PCB-12/13	SS00442RM			<10
PCB-12/13	SS00443RM			<10
PCB-12/13	SS00444RM			<10
PCB-12/13	SS00445RM		<u> </u>	<10
PCB-12/13	SS00446RM(dup)			<10
PCB-12/13	SS00447RM		.27	<10
PCB-12/13	SS00448RM			<10
PCB-12/13	SS00449RM		<b></b>	<10
PCB-12/13	SS00450RM	<del></del>	U	<10
PCB-12/13	SS00451RM		ļ	<10
PCB-12/13	SS00452RM			<10

		Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location 12/12	Numbers	(ppm)	(ppm)	(ppm)
PCB-12/13	SS00453RM		<del> </del>	<10
PCB-12/13	SS00454RM		.67	<10 <10
PCB-12/13 PCB-12/13	SS00455RM SS00456RM		67	<10
PCB-12/13	SS00457RM		<del> </del>	<10
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PCB-12/13	SS00471RM			<10
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PCB-12/13	SS00473RM		.28	<10
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PCB-12/13	SS00475RM			<10
PCB-12/13	SS00476RM			<10
PCB-12/13	SS00477RM		.13	<10
PCB-12/13	SS00478RM			<10
PCB-12/13	SS00479RM(dup)			<10
PCB-12/13	SS00480RM			<10
PCB-12/13	SS00481RM		.34	<10
PCB-12/13	SS00482RM			<10
PCB-12/13	SS00483RM	<u> </u>		<10
PCB-12/13	SS00484RM		ļl	<10
PCB-12/13	SS00485RM		<u> </u>	<10
			L	
PCB-17	CT00014EG	<u>.</u> 12		
PCB-17	CT00015EG	.13	L	
PCB-17	CT00016EG	3.60	<del>  </del>	
PCB-17	SS00065RM		L	<10
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PCB-17	SS00092RM SS00093RM		<del>                                     </del>	<10
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PCB-17	SS00094RM		1.30	<10

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		Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location	Numbers	(ppm)	(ppm)	(ppm)
PCB-17	SS00096RM			<10
PCB-17	SS00097RM		.47	<10
PCB-17	SS00098RM			<10
PCB-17	SS00099RM			<10
PCB-17	SS00101RM	***************************************		<10
PCB-17	SS00102RM			<10
PCB-20	CT00035EG	.73		
PCB-20	CT00036EG	.86		
PCB-20	SS00011RM		.93	<10
PCB-20	SS00012RM			<10
PCB-20	SS00013RM			<10
PCB-20	SS00014RM			<10
PCB-20	SS00015RM			<10
PCB-20	SS00016RM		.14	<10
PCB-20	SS00017RM			<10
PCB-20	SS00018RM			<10
PCB-20	SS00019RM			<10
PCB-20	SS00040RM(dup)		LT	<10
PCB-21	CT00001EG	U		
PCB-21	CT00002EG	10		
PCB-21	CT00003EG	56.0		
PCB-21	SS00295RM			>10
PCB-21	SS00349RM			>10
PCB-21	SS00350RM(dup)			<10
PCB-21_	SS00351RM		<u> </u>	<10
PCB-21	SS00352RM		3.10	<10
PCB-21	SS00353RM		l	<10
PCB-21	SS00355RM			<10
PCB-21	SS00359RM		.23	<10
PCB-21	SS00363RM		L	<10
PCB-21	SS00364RM		.80	<10
PCB-21	SS00367RM		.24	<10
PCB-21	SS00368RM			<10
PCB-21	SS00371RM			<10
PCB-21	SS00372RM			<10
PCB-21	SS00375RM			<10
PCB-21	SS00376RM			<10
PCB-21	SS00379RM(dup)		<b> </b>	<10
PCB-21	SS00405RM		Ļ <u>-</u>	<10
PCB-21	SS00407RM		ļļ.	<10
PCB-21	SS00411RM		<b></b> _	<10
PCB-21	SS00413RM		ļ	<10
PCB-21	SS00415RM		<del> </del>	<10
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PCB-21	SS00497RM		.94	<10
PCB-21	SS00498RM		.94	<10
PCB-21	SS00500RM SS00525RM		.00	<10 <25
PCB-21	SSUUSZSKIVI		<u></u>	\43

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non di		Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location	Numbers	(ppm)	(ppm)	(ppm)
PCB-21	SS00526RM		11.0	<25
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PCB-21	SS00531RM		5.70	<10
PCB-21	SS00532RM			<25
PCB-21	SS00533RM		70.0	>25
PCB-21	SS00534RM		46.0	>25
PCB-21	SS00535RM		46.0	>25
PCB-21	SS00536RM(dup)			>25
PCB-21	SS00537RM		49.0	>25
PCB-21	SS00538RM		56.0	>25
PCB-21	SS00539RM		15.0	>25
PCB-23	CT00004EG	.04		
PCB-23	CT00005EG	U	T	
PCB-23	CT00006EG	U		
PCB-23	CT00007EG	U	lT	
PCB-23	SS00131RM			<10
PCB-23	SS00132RM		2.98	<10
PCB-23	SS00133RM			<10
PCB-23	SS00134RM			<10
PCB-23	SS00135RM			<10
PCB-23	SS00138RM			<10
PCB-23	SS00140RM			<10
PCB-23	SS00141RM			<10
PCB-23	SS00142RM			<10
PCB-23	SS00144RM			<10
PCB-23	SS00145RM		.06	<10
PCB-23	SS00146RM(dup)			<10
PCB-23	SS00147RM			<10
PCB-23	SS00149RM			<10
PCB-23	SS00150RM		.42	<10
PCB-23	SS00151RM			<10
PCB-23	SS00152RM			<10
PCB-23	SS00153RM	<del> </del>		<10
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PCB-23	SS00155RM(dup)			<10
PCB-23	SS00156RM		<del></del>	<10
PCB-23	SS00157RM	·· <del>·</del>		<10
PCB-23	SS00197RM		.46	<10
PCB-23	SS00198RM		<del></del>	<10
PCB-23	SS00199RM	*****	<b></b>	<10
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PCB-23	SS00203RM		.09	<10
PCB-23	SS00204RM			<10
PCB-23	SS00205RM(dup)		<u> </u>	<10
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PCB-23	SS00265RM		.11	<10
PCB-23	SS00266RM		<del> </del>	<10
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1 CD-23	BBOODORIN	<del></del>	<del>  -</del>	
PCB-24	CT00008EG	U	<del></del>	
PCB-24 PCB-24	CT00009EG	U		
PCB-24	CT00009EG	Ū		
FCD-24	C100010EG		<u></u>	

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DOD G'A	S	Method 8080 Concrete Results	Method 8080 Soil Results	Method 4020
PCB Site	Sample Numbers	(ppm)	(ppm)	Immunoassay Results
Location PCB-24	SS00255RM	(ppm)	(ppin)	(ppm)
PCB-24 PCB-24	SS00255RM SS00256RM		.04	<10 <10
PCB-24	SS00250RM SS00257RM		.04	<10
PCB-24	SS00257RM SS00258RM		U	<10
PCB-24	SS00259RM			<10
	SS00239RM SS00260RM			<10
PCB-24 PCB-24	SS00260RM SS00261RM			<10
PCB-24 PCB-24	SS00261RM SS00262RM	<u> </u>		<10
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PCB-24	SS00300RM			<10
PCB-24	SS00301RM		3.20	<10
PCB-24	SS00302RM		5.20	<10
PCB-24	SS00305RM		2.10	<10
PCB-24	SS00309RM			<10
PCB-24	SS00310RM		.32	<10
PCB-24	SS00310RM SS00311RM			<10
PCB-24	SS00317RM SS00312RM			<10
PCB-24	SS00312RM		<del>                                     </del>	<10
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PCB-24	SS00320RM(dup)		<del>                                     </del>	<10
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PCB-25	SS00173RM			<10
PCB-25	SS00174RM			<10
PCB-25	SS00175RM			<10
PCB-25	SS00176RM			<10
PCB-25	SS00177RM		1.10	<10
PCB-25	SS00178RM			<10
PCB-25	SS00179RM			<10
PCB-25	SS00183RM			<10
PCB-25	SS00184RM			<10
PCB-25	SS00185RM		1.39	<10_
PCB-25	SS00186RM			<10
PCB-25	SS00187RM			<10
PCB-25	SS00188RM			<10
PCB-25	SS00191RM(dup)			<10
PCB-25	SS00195RM			<10
PCB-25	SS00198RM			<10
PCB-25	SS00206RM		12.0	<10
PCB-25	SS00207RM			<10
PCB-25	SS00208RM			<10
PCB-25	SS00209RM			<10
PCB-25	SS00210RM			<10
PCB-25	SS00211RM			<10
PCB-25	SS00212RM		2.05	<10
PCB-25	SS00213RM		2.06	<10
PCB-25	SS00214RM		ļI	<10
PCB-25	SS00215RM			<10
PCB-25	SS00216RM(dup)			<10
PCB-25	SS00217RM		.53	<10_

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Location   Numbers   (ppm)   (ppm)   (ppm)     PCB-25   SS00218RM   <10     PCB-25   SS00219RM   <10     PCB-25   SS00220RM   <10     PCB-25   SS00221RM   <10     PCB-25   SS00221RM   <10     PCB-25   SS00222RM   <10     PCB-25   SS00222RM   <10     PCB-26   CT00011EG   U     PCB-26   CT00012EG   .03     PCB-26   CT00013EG   U     PCB-26   SS00103RM   <10     PCB-26   SS00103RM   <10     PCB-26   SS00108RM   .16   <10     PCB-26   SS00109RM   <10     PCB-26   SS00109RM   <10     PCB-26   SS00110RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00123RM   <10     PCB-26   SS00123RM   <10     PCB-26   SS00124RM   <10     PCB-26   SS00125RM   <10     PCB-26   SS00136RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00162RM   <10     PCB-26   SS00162RM   <10     PCB-26   SS00162RM   <10     PCB-26   SS00163RM   <10     PCB-26   SS00164RM   <10     PCB-26   SS00165RM   <1	
PCB-25   SS00219RM   <10     PCB-25   SS00220RM   <10     PCB-25   SS00221RM   <10     PCB-25   SS00221RM   <10     PCB-25   SS00222RM   <10     PCB-26   CT00011EG   U     PCB-26   CT00012EG   .03     PCB-26   CT00013EG   U     PCB-26   SS00103RM   <10     PCB-26   SS00104RM   <10     PCB-26   SS00108RM   .16   <10     PCB-26   SS00108RM   .16   <10     PCB-26   SS00109RM   <10     PCB-26   SS00110RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00123RM   <10     PCB-26   SS00124RM   <10     PCB-26   SS00124RM   <10     PCB-26   SS00125RM   <10     PCB-26   SS00127RM   <10     PCB-26   SS00127RM   <10     PCB-26   SS00127RM   <10     PCB-26   SS00127RM   <10     PCB-26   SS00128RM   <10     PCB-26   SS00130RM(dup)   <10     PCB-26   SS00130RM(dup)   <10     PCB-26   SS00158RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00160RM   .65   <10     PCB-26   SS00160RM   .65   <10     PCB-26   SS00163RM   .10     PCB-26   SS00163RM   .590   <10     PCB-26   SS00163RM   .10     PCB-26   SS00165RM   .10     PCB-26	
PCB-25   SS00220RM   <10     PCB-25   SS00221RM   <10     PCB-25   SS00222RM   <10     PCB-26   CT00011EG   U     PCB-26   CT00012EG   .03     PCB-26   CT00013EG   U     PCB-26   SS00103RM   <10     PCB-26   SS00104RM   <10     PCB-26   SS00108RM   .16   <10     PCB-26   SS00109RM   <10     PCB-26   SS00109RM   <10     PCB-26   SS00110RM   <10     PCB-26   SS00114RM   <10     PCB-26   SS00123RM   <10     PCB-26   SS00123RM   <10     PCB-26   SS00124RM   <10     PCB-26   SS00125RM   <10     PCB-26   SS00125RM   <10     PCB-26   SS00127RM   <10     PCB-26   SS00128RM   <10     PCB-26   SS00128RM   <10     PCB-26   SS00128RM   <10     PCB-26   SS00138RM   <10     PCB-26   SS00138RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00158RM   <10     PCB-26   SS00160RM   .65   <10     PCB-26   SS00160RM   .65   <10     PCB-26   SS00164RM   .60   <10     PCB-26   SS00164RM   .60   <10     PCB-26   SS00164RM   .61   <10     PCB-26   SS00164RM   .61   <10     PCB-26   SS00165RM   .61   <10     PCB-26   SS00164RM   .61   <10     PCB-26   SS00164RM   .61   <10     PCB-26   SS00165RM   .61   <10   <10     PCB-26   SS00165RM   .61   <10   <10   <10     PCB-26   SS00165RM   .61   <10   <10     PCB-26   SS00165RM   .61   <10   <10   <10     PCB-26   SS00165RM   .61   <10   <10   <10     PCB-26   SS00165RM   .61   <10   <10   <10	
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PCB-25         SS00222RM         <10           PCB-26         CT00011EG         U           PCB-26         CT00012EG         .03           PCB-26         CT00013EG         U           PCB-26         SS00103RM         <10	
PCB-26         CT00011EG         U           PCB-26         CT00012EG         .03           PCB-26         CT00013EG         U           PCB-26         SS00103RM         <10	
PCB-26         CT00012EG         .03           PCB-26         CT00013EG         U           PCB-26         SS00103RM         <10	
PCB-26         CT00012EG         .03           PCB-26         CT00013EG         U           PCB-26         SS00103RM         <10	
PCB-26         CT00013EG         U           PCB-26         SS00103RM         <10	
PCB-26         SS00103RM         <10	
PCB-26         SS00104RM         <10	
PCB-26         SS00106RM         .16         <10	
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PCB-26         SS00114RM         <10	
PCB-26         SS00118RM         <10	
PCB-26         SS00123RM         <10	
PCB-26         SS00124RM         <10	
PCB-26         SS00125RM         <10	
PCB-26         SS00126RM         <10	
PCB-26         SS00127RM         <10	
PCB-26         SS00128RM         <10	
PCB-26         \$S\$00130RM(dup)         <10	
PCB-26         SS00158RM         <10	
PCB-26         SS00160RM         .65         <10           PCB-26         SS00161RM         <10	
PCB-26         SS00161RM         <10           PCB-26         SS00162RM         5.90         <10	
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PCB-26         SS00163RM         <10           PCB-26         SS00164RM         <10	
PCB-26         SS00164RM         <10           PCB-26         SS00165RM         .09         <10	
PCB-26 SS00165RM .09 <10	
DOD 04	
PCB-26 SS00166RM <10	
PCB-26 SS00167RM <10	
PCB-26 SS00168RM 2.80 <10	
PCB-26 SS00169RM(dup) <10	
PCB-26 SS00170RM 2.30 <10	
PCB-26 SS00171RM U <10	
PCB-33 CT00029EG .21	——
PCB-33 CT00030EG 1.30	
PCB-33 CT00030EG 1.50 PCB-33 CT00031EG .21	
PCB-33 CT00032EG U	
PCB-33 SS00001RM <10	
PCB-33 SS00002RM U <10	
PCB-33 SS00004RM U <10	
PCB-33 SS00004RM 0 <10  PCB-33 SS00005RM <10	
PCB-33 SS00003RM <10 <10	
PCB-33 SS00010RM(dup) <10	
	——
PCB-37 CT00051EG U	
PCB-37 CT00052EG U	
PCB-37 CT00053EG U	
PCB-37 CT00054EG U	
PCB-37 CT00055EG .24	
PCB-37 CT00056EG U	
PCB-37 CT00057EG 1.40	
PCB-37 CT00058EG U	

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DOD GO		Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location	Numbers	(ppm)	(ppm)	(ppm)
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PCB-37	CT00060EG	U	<del> </del>	
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PCB-37	CT00062EG	U	<del> </del>	
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PCB-37	CT00064EG	Ü	<del> </del>	
PCB-37	CT00065EG(dup)	<u> </u>	<del> </del>	
PCB-37	CT00066EG	U		
PCB-37	CT00067EG	U		<del></del>
PCB-37	CT00068EG	U	L	
PCB-37	CT00069EG	U		
PCB-37	CT00070EG	U		
PCB-37	CT00071EG	U		
PCB-37	CT00072EG(dup)	U		
PCB-37	CT00073EG	U		
PCB-37	CT00074EG	U		
PCB-37	SS00540RM			<10
PCB-37	SS00541RM			<10
PCB-37	SS00542RM			<10
PCB-37	SS00543RM			<10
PCB-37	SS00544RM(dup)	···	<del> </del>	<10
PCB-37	SS00545RM		Ū	<10
PCB-37	SS00546RM		.38	<10
PCB-37	SS00547RM		<del> </del>	<10
PCB-37	SS00547RM		U	<10
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PCB-37	SS00555RM	<del></del> _	ļ	<10
PCB-37	SS00556RM		U	<10
PCB-37	SS00557RM	<del></del>	<del></del>	<10
PCB-37	SS00558RM			<10
PCB-37	SS00559RM			<10
PCB-37	SS00560RM			<10
PCB-37	SS00561RM	<del></del>		<10
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PCB-37	SS00563RM		U	<10
PCB-37	SS00564RM			<10
PCB-37	SS00565RM(dup)	· · · · · · · · · · · · · · · · · · ·		<10
PCB-37	SS00566RM			<10
PCB-37	SS00567RM			<10
PCB-37	SS00568RM			<10
PCB-37	SS00569RM		4.30	<25
PCB-37	SS00570RM			<25
PCB-37	SS00571RM			<25
PCB-37	SS00572RM		.20	<10
PCB-37	SS00574RM			<10
PCB-37	SS00576RM			<10
PCB-37	SS00577RM			<10
PCB-37	SS00578RM		.77	<10
PCB-37	SS00579RM		<del></del>	<10
PCB-37	SS00580RM		<del></del>	<10
PCB-37	SS00581RM			<10
PCB-37	SS00583RM		.24	<10
( CD-31	INTUCOCOOCO I			<10

		Method 8080	Method 8080	Method 4020
PCB Site	Sample	Concrete Results	Soil Results	Immunoassay Results
Location	Numbers	(ppm)	(ppm)	(ppm)
PCB-37	SS00584RM			<10
PCB-37	SS00585RM		.10	<10
PCB-37	SS00586RM			<10
PCB-37	SS00587RM			<10
PCB-37	SS00588RM			<10
PCB-37	SS00589RM		l	<10
PCB-37	SS00590RM			<10
PCB-37	SS00591RM		U	<10
PCB-37	SS00592RM			<10
PCB-37	SS00593RM(dup)			<10
PCB-37	SS00594RM			<10
PCB-37	SS00595RM			<10
PCB-37	SS00596RM			<10
PCB-37	SS00597RM			<10
PCB-37	SS00598RM			<10
PCB-37	SS00599RM			<10
PCB-37	SS00600RM		U	<10
PCB-37	SS00601RM			<10
PCB-37	SS00602RM			<10
PCB-37	SS00603RM		U	<10
PCB-37	SS00604RM			<10
PCB-37	SS00605RM			<10
PCB-37	SS00606RM			<10
PCB-37	SS00607RM(dup)		l	<10
PCB-37	SS00608RM			<10
PCB-37	SS00609RM		U	<25
PCB-37	SS00610RM			<10
PCB-37	SS00611RM			<10
PCB-37	SS00612RM		.59	<10
PCB-37	SS00613RM			<10
PCB-37	SS00614RM			<10
PCB-37	SS00615RM		<u> </u>	<10
PCB-37	SS00616RM		3.06	<25
PCB-37	SS00617RM	'		<25
Fill Material	SS00020RM		U	
Fill Material	SS00254RM		U	

# Sample Number prefixes

CT = Concrete

SS = Soil

U = not detected

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# 4.0 Waste Disposal

Approximately 500 yd<sup>3</sup> of contaminated soil and concrete was excavated from all of the sites and shipped to an EPA-approved, TSCA-permitted chemical waste landfill in Kettleman, California. In addition to the contaminated soil and concrete waste, Personal Protective Equipment (PPE) waste and immunoassay residual lab wastes were also shipped to Kettleman.

Concrete and/or asphalt from PCB Site 17 (near Bldg. 883), PCB Site 23, (northeast corner of Bldg. 559), PCB Site 24 (west of Bldg. 708), and PCB Site 26 (east of Bldg. 750) was shipped to the Rocky Flats onsite landfill for disposal. This overlying material was sampled using Method 8080 and removed to facilitate the excavation of underlying contaminated soils. All of the destructive samples collected from the above mentioned sites were <10 ppm PCBs. Table 4-1 shows the volume of PCB contaminated waste generated per site.

Table 4-1. PCB-Contaminated Waste Removed Per Site.

Site	Soil Removed (yd³)	Concrete Removed (yd³)
PCB-10 (555/558 Substation)	4.3	0
PCB-12/13 (661/675 Substation)	46.7	0
PCB-17 (Bldg. 883)	22.1	2 (asphalt) + 8.5 (concrete)
PCB-20 (515/516 Substation)	5.8	0
PCB-21 (Bldg. 776)	177	10.7
PCB-23 (Bldg. 559)	27.2	2.5
PCB-24 (Bldg. 708)	24.1	1.5
PCB-25 (Bldg. 707)	64.8	0
PCB-26 (Bldg. 750)	12.1	8.0
PCB-33 (Bldg. 371)	1.08	0
PCB-37 (Bldg. 662)	85.1	0
TOTAL	470.8	33.2

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# 5.0 Conclusions

The PCB remediation was performed in accordance with the Final PAM, PCB Remediation (DOE 1995), Final SAP, (RMRS 1995a), and Final Project-Specific Health and Safety Plan (RMRS 1995b). Eleven PACs, which correspond to 13 of the originally designated PCB sites (EG&G 1991), were remediated to below 25 ppm total PCB standard. As a result, these sites were submitted for proposed No Further Action (NFA) status in the Annual Update for the Historical Release Report (DOE 1996b). These sites will be officially closed under the Industrial Area OU ROD.

PCB concentrations in two areas at PCB Site 21 (approximately 0.23 yd³ total) remain at levels greater than 10 ppm, but less than 25 ppm. Six attempts to adequately remediate PCB Site 21 were made. One small area (approximately 1.1 yd³) remains at 70 ppm PCBs. The excavation progressed to a depth of 17 feet and, due to physical constraints and health and safety concerns, additional excavation at PCB Site 21 was ceased with the concurrence of the EPA. The Industrial Area OU ROD will also address PCB Site 21 at which residual concentrations above the 25 ppm standard remain.

Approximately 2,500 field screening samples were collected and analyzed during the course of the project resulting in significant cost savings over conventional laboratory analysis. Utilization of SW-846 Draft Method 4020 allowed remediation activities to continue while samples were being analyzed on location in a mobile laboratory. The approach also included targeting a 10 ppm remediation goal to assure that the 25 ppm cleanup standard was achieved. Final verification split samples and quality control samples were collected under accepted MRI protocols once the 4020 screens showed less than 10 ppm. Final cleanup verification samples were analyzed using EPA Method 8080 (see Appendix B). The MRI site verification sampling grids, EPA Method 8080 analysis, and specific MRI guidance documentation utilized in executing the project are included as appendixes. The validation results will be evaluated for data usability as part of the quality control for the project and submitted as an addendum to this report. All of the remediation sites addressed in this completion report were restored to, at a minimum, their original condition. There were no injuries during this project.

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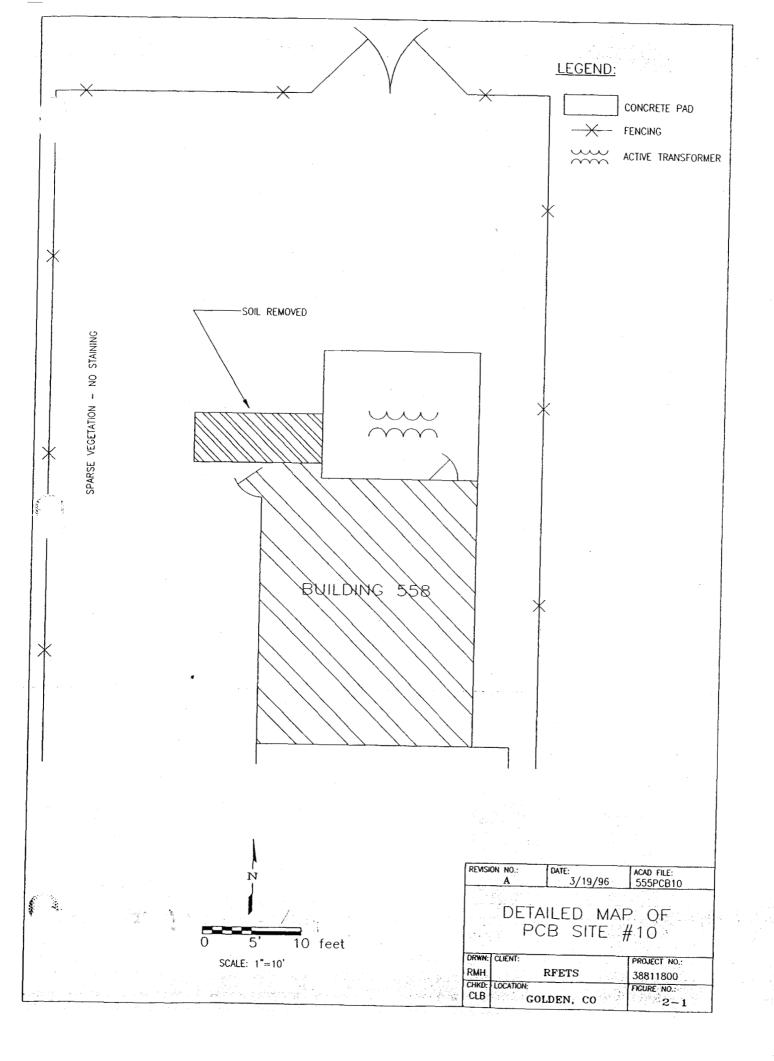
# 5.0 Conclusions

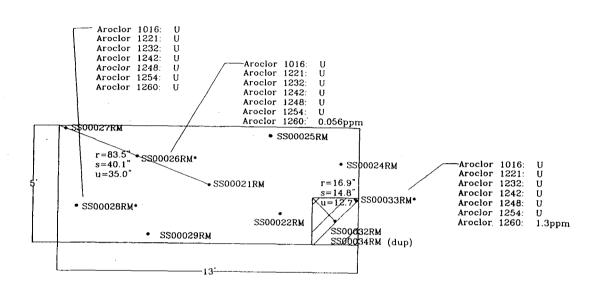
The PCB remediation was performed in accordance with the Final PAM, PCB Remediation (DOE 1995), Final SAP, (RMRS 1995a), and Final Project-Specific Health and Safety Plan (RMRS 1995b). Eleven PACs, which correspond to 13 of the originally designated PCB sites (EG&G 1991), were remediated to below 25 ppm total PCB standard. As a result, these sites were submitted for proposed No Further Action (NFA) status in the Annual Update for the Historical Release Report (DOE 1996b). These sites will be officially closed under the Industrial Area OU ROD.

PCB concentrations in two areas at PCB Site 21 (approximately 0.23 yd³ total) remain at levels greater than 10 ppm, but less than 25 ppm. Six attempts to adequately remediate PCB Site 21 were made. One small area (approximately 1.1 yd³) remains at 70 ppm PCBs. The excavation progressed to a depth of 17 feet and, due to physical constraints of the equipment and health and safety concerns, additional excavation at PCB Site 21 was ceased. The Industrial Area OU ROD will also address PCB Site 21 at which residual concentrations above the 25 ppm standard remain.

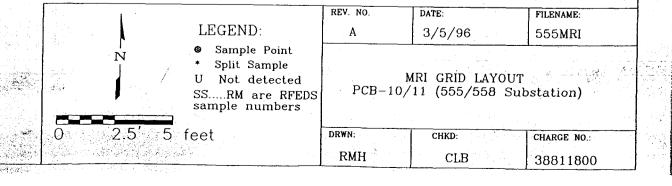
Approximately 2,000 field screening samples were collected and analyzed during the course of the project resulting in significant cost savings over conventional laboratory analysis. Utilization of SW-846 Draft Method 4020 allowed remediation activities to continue while samples were being analyzed on location in a mobile laboratory. The approach also included targeting a 10 ppm remediation goal to assure that the 25 ppm cleanup standard was achieved. Final verification split samples and quality control samples were collected under accepted MRI protocols once the 4020 screens showed less than 10 ppm. Final cleanup verification samples were analyzed using EPA Method 8080 (see Appendix B). The MRI site verification sampling grids, EPA Method 8080 analysis, and specific MRI guidance documentation utilized in executing the project are included as appendixes. The validation results will be evaluated for data usability as part of the quality control for the project and submitted as an addendum to this report. All of the remediation sites addressed in this completion report were restored to, at a minimum, their original condition. There were no injuries during this project.

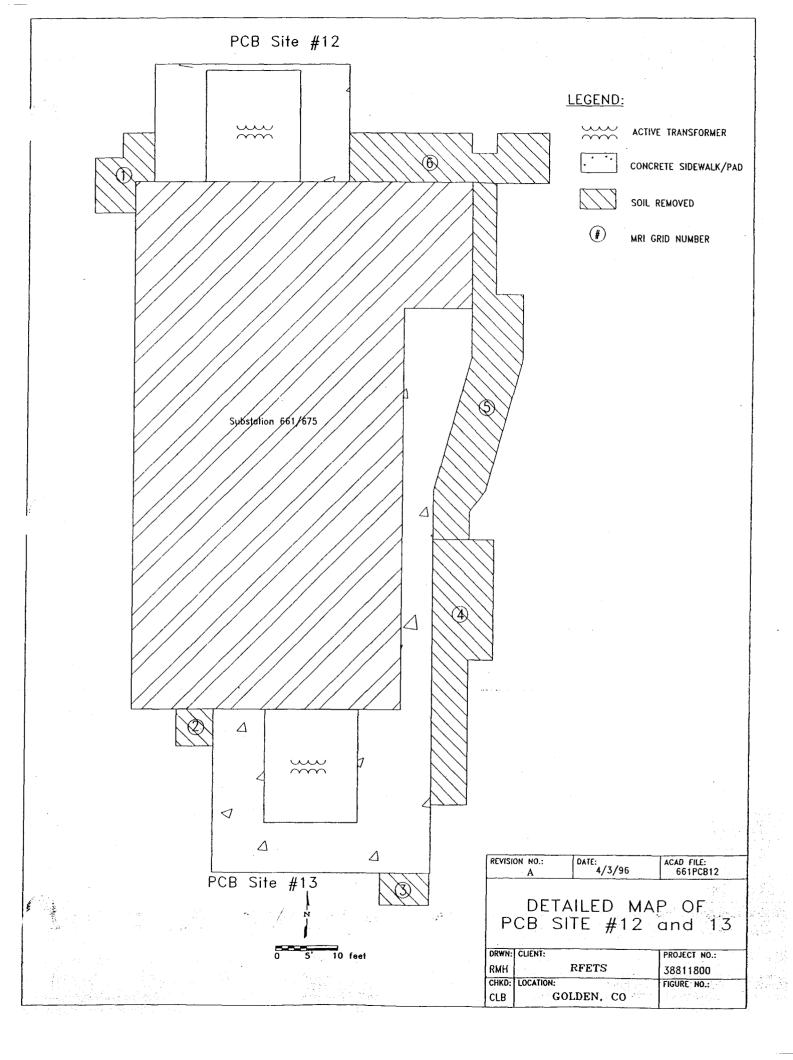
# Appendix A Site Maps

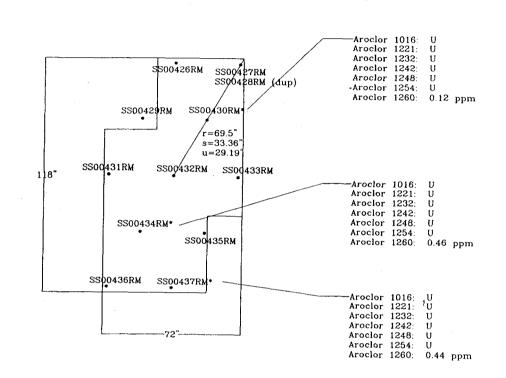




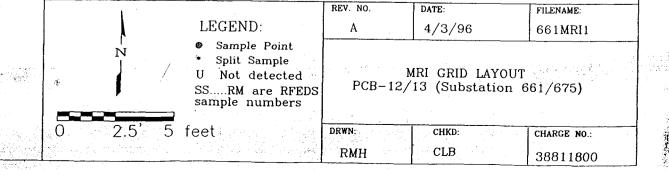
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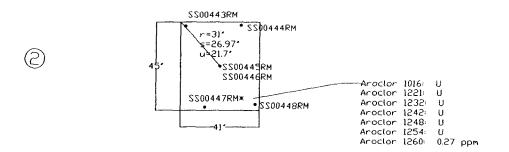


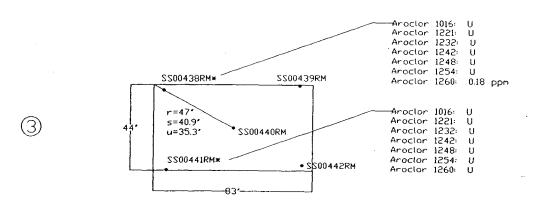




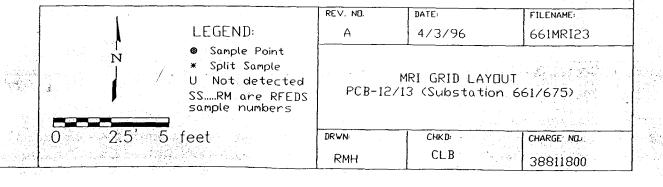
 $\underline{\underline{\text{Note:}}}$  All samples are <10ppm PCBs by immunoassay analysis.

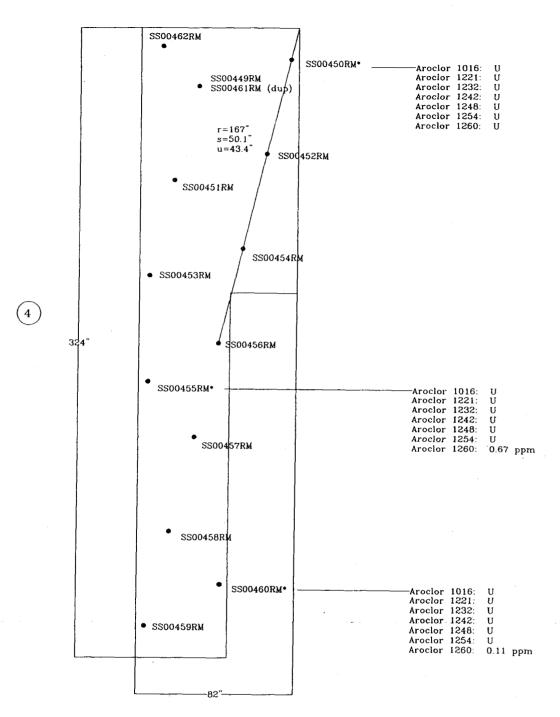




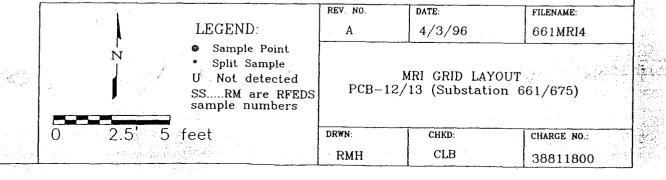


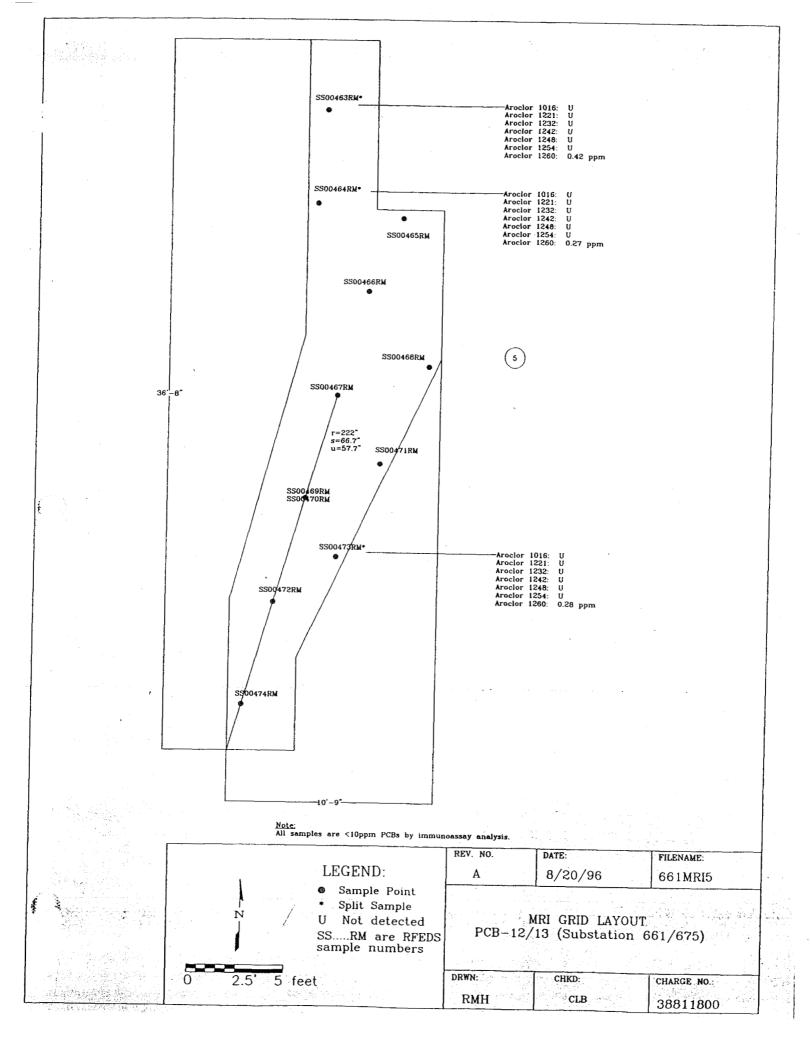
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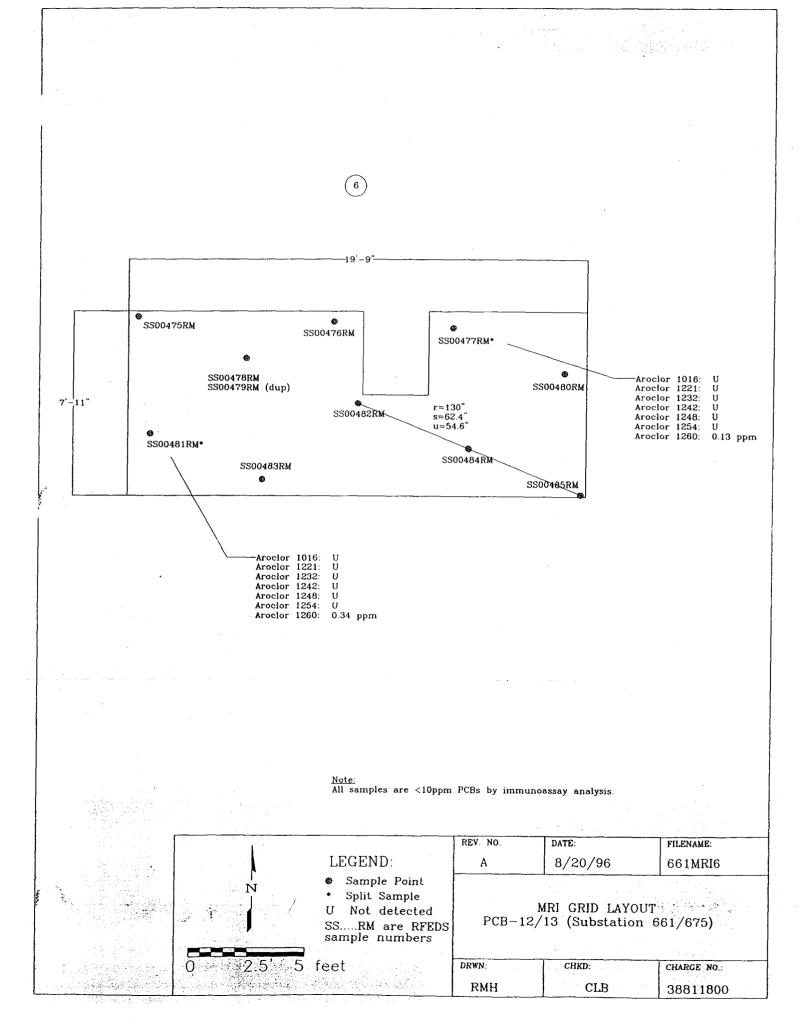


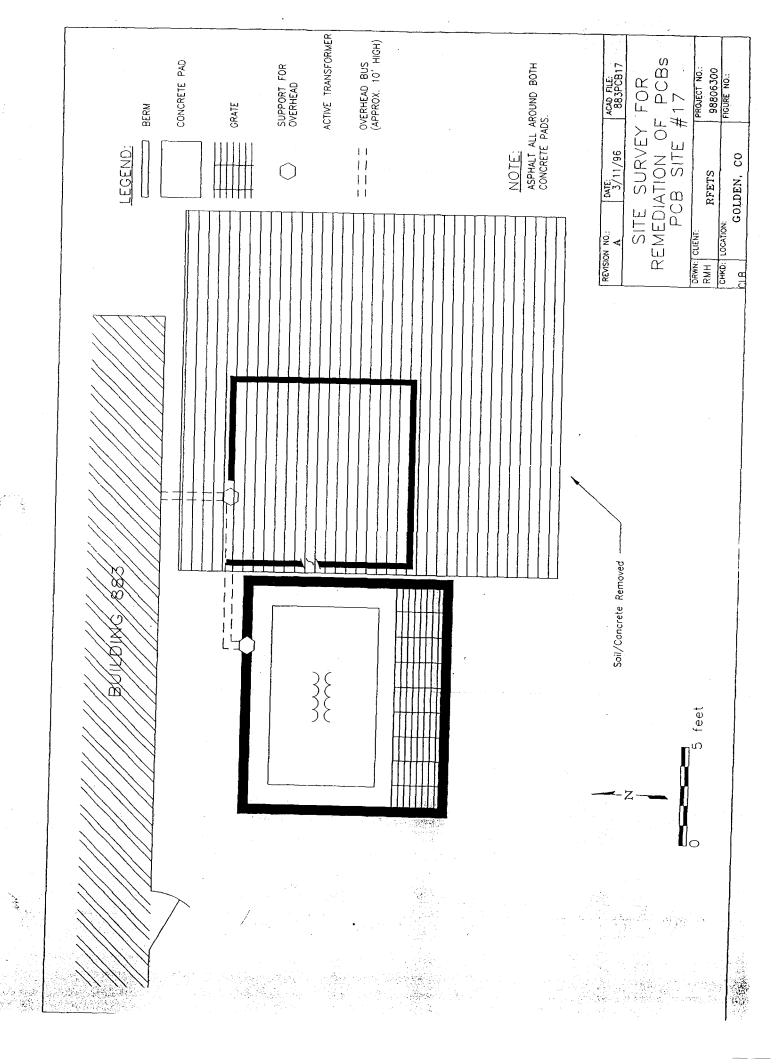


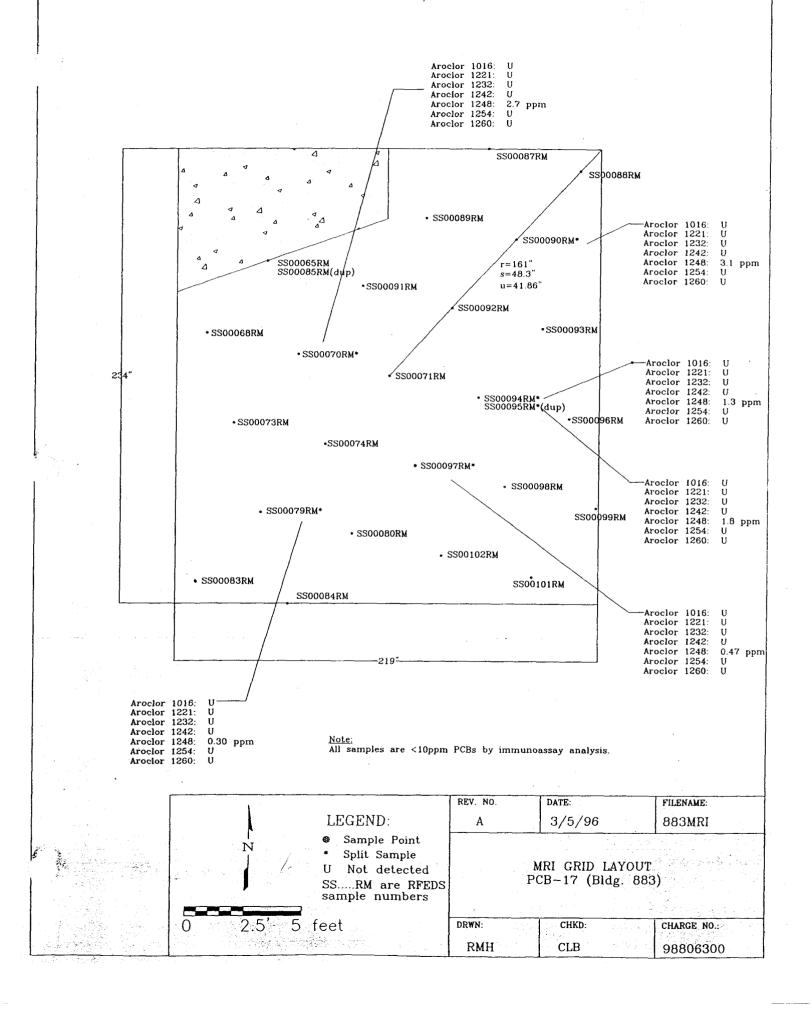
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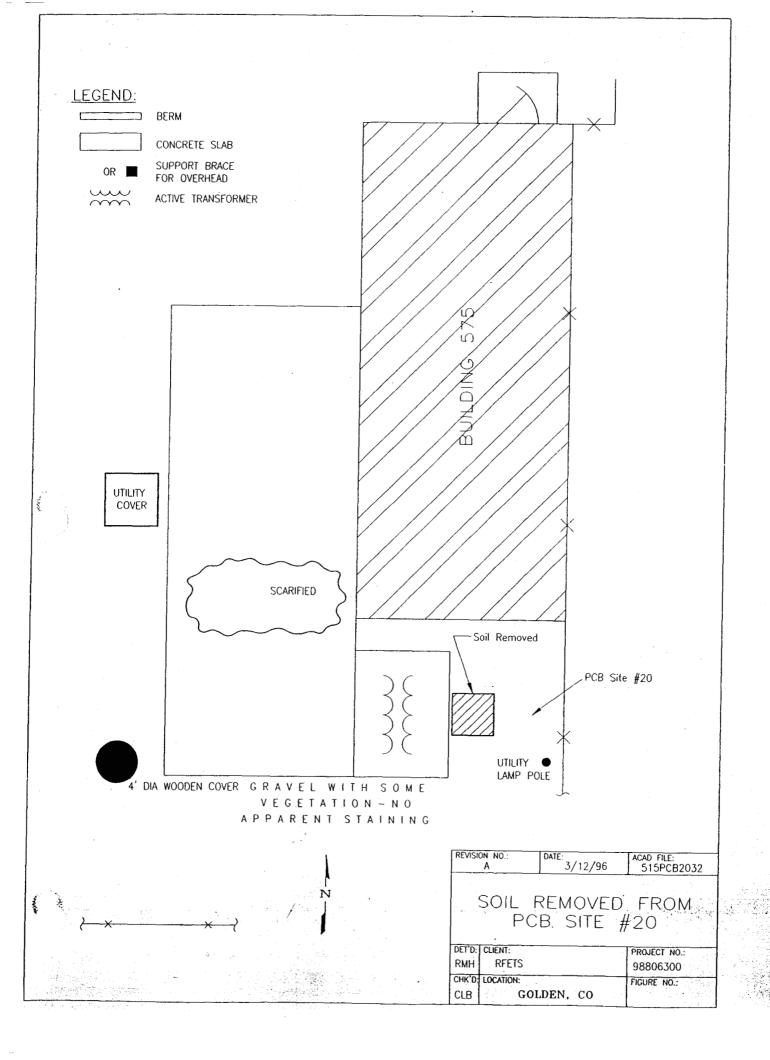


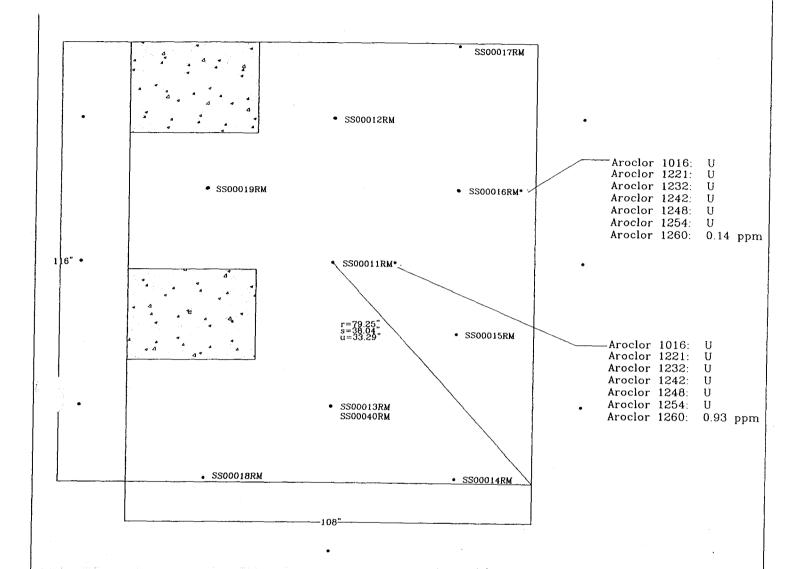




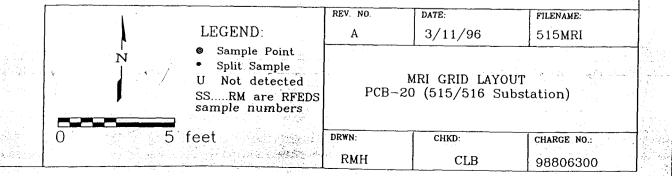


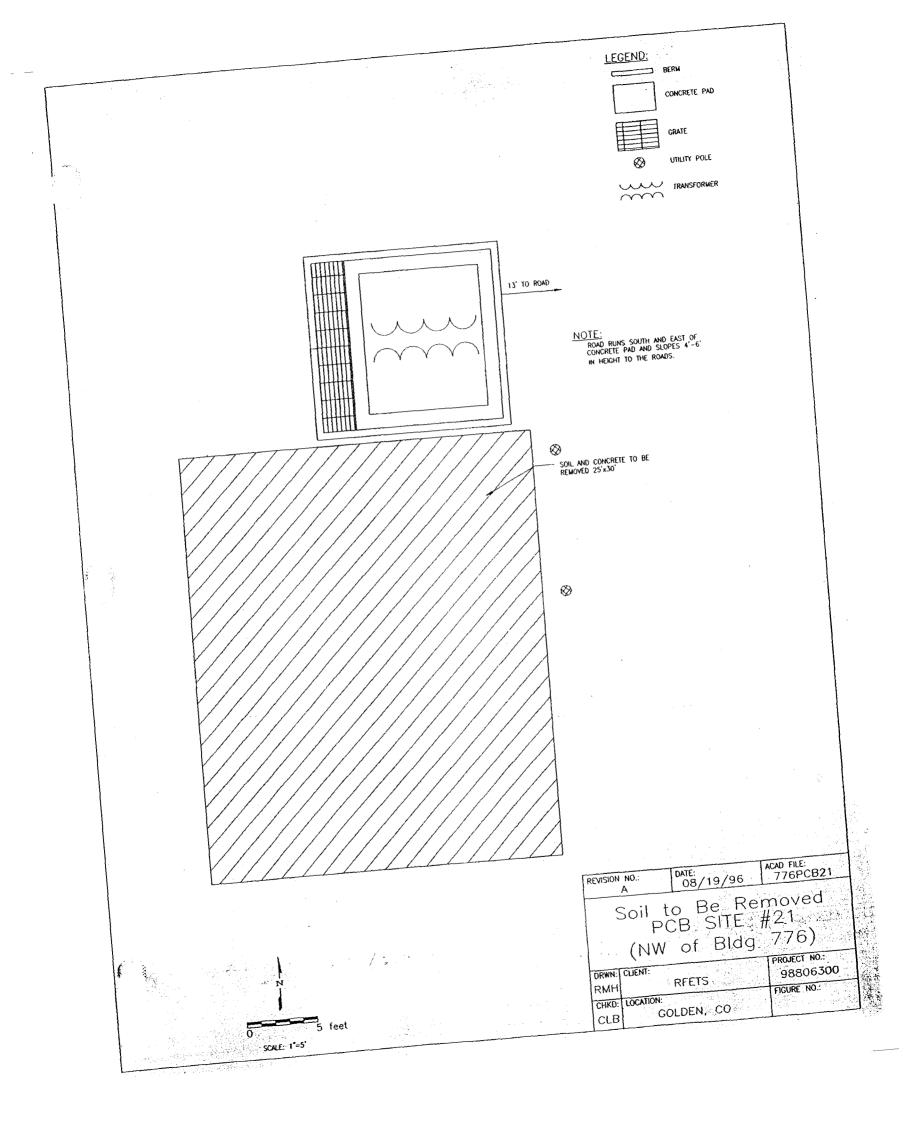


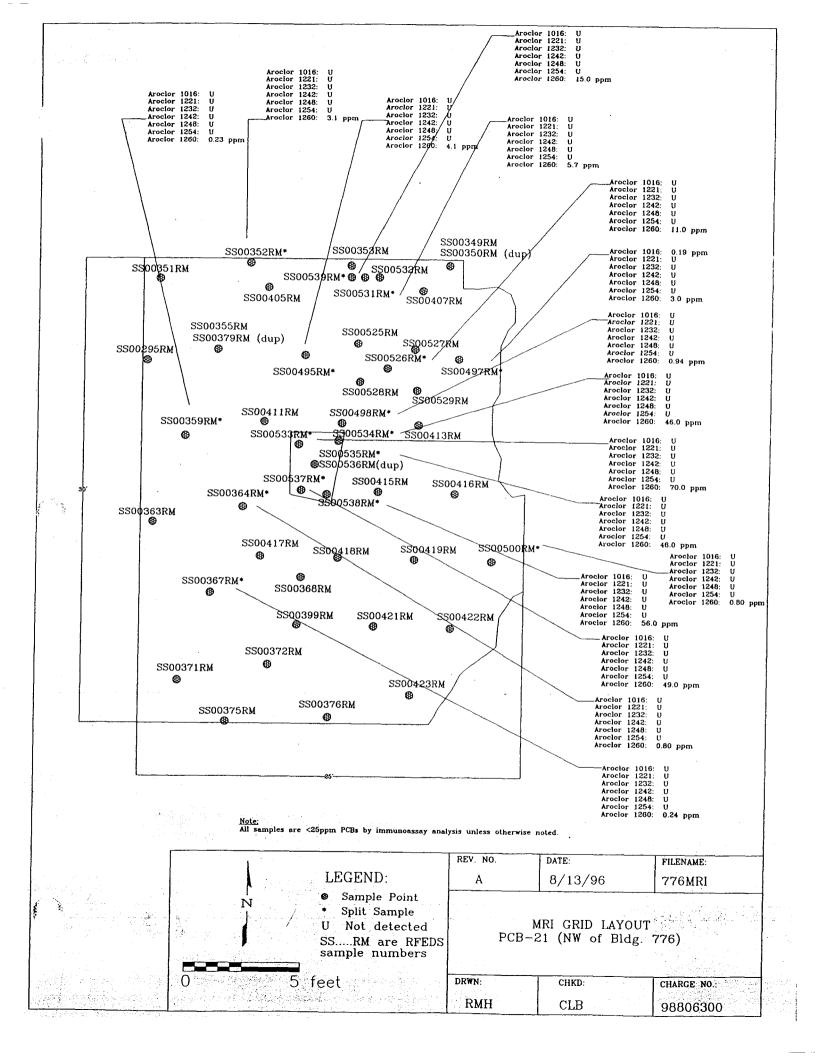


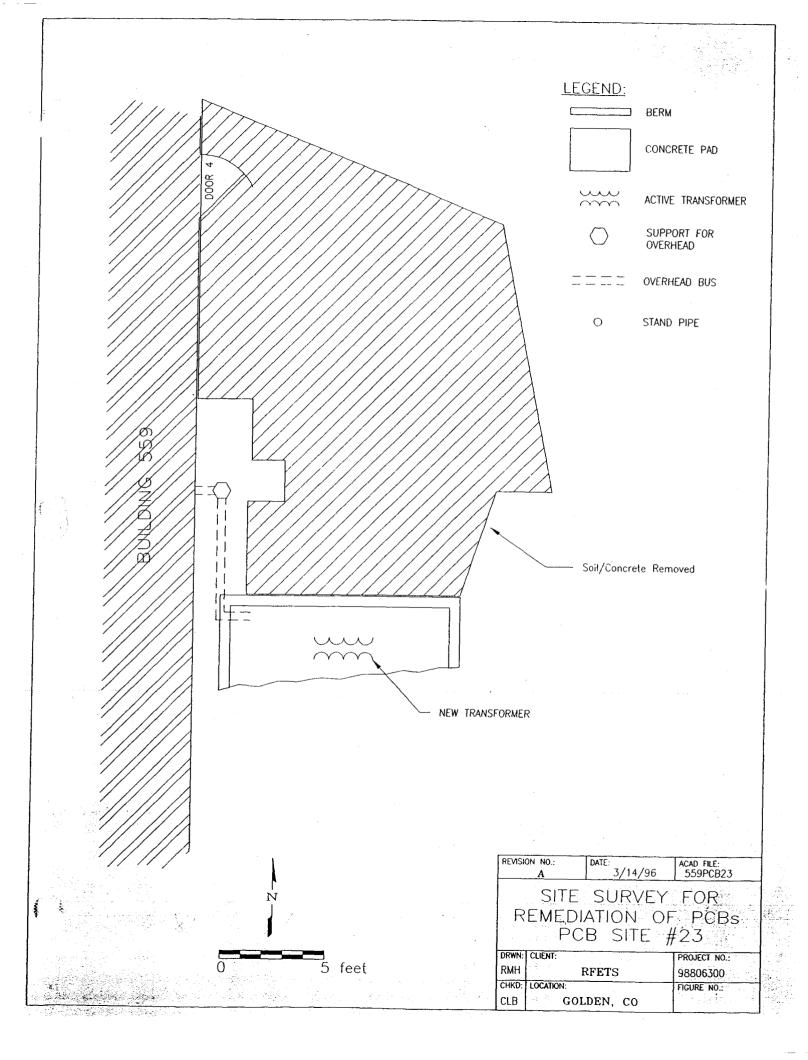


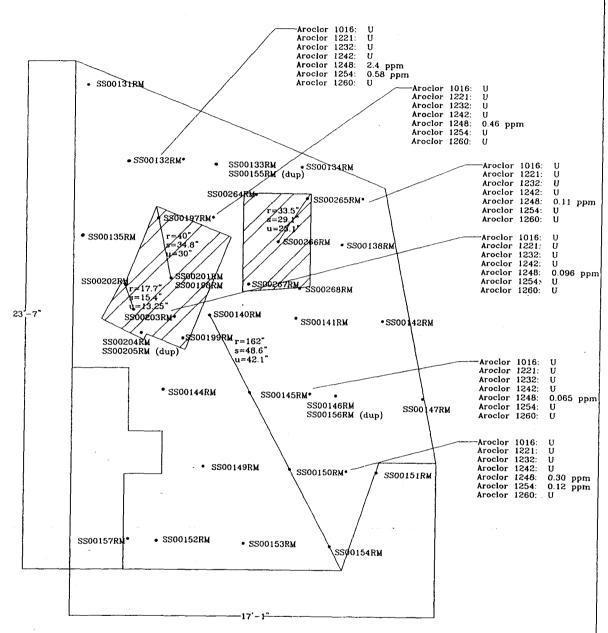
 $\underline{\underline{Note}}$ . All samples are <10ppm PCBs by immunoassay analysis.





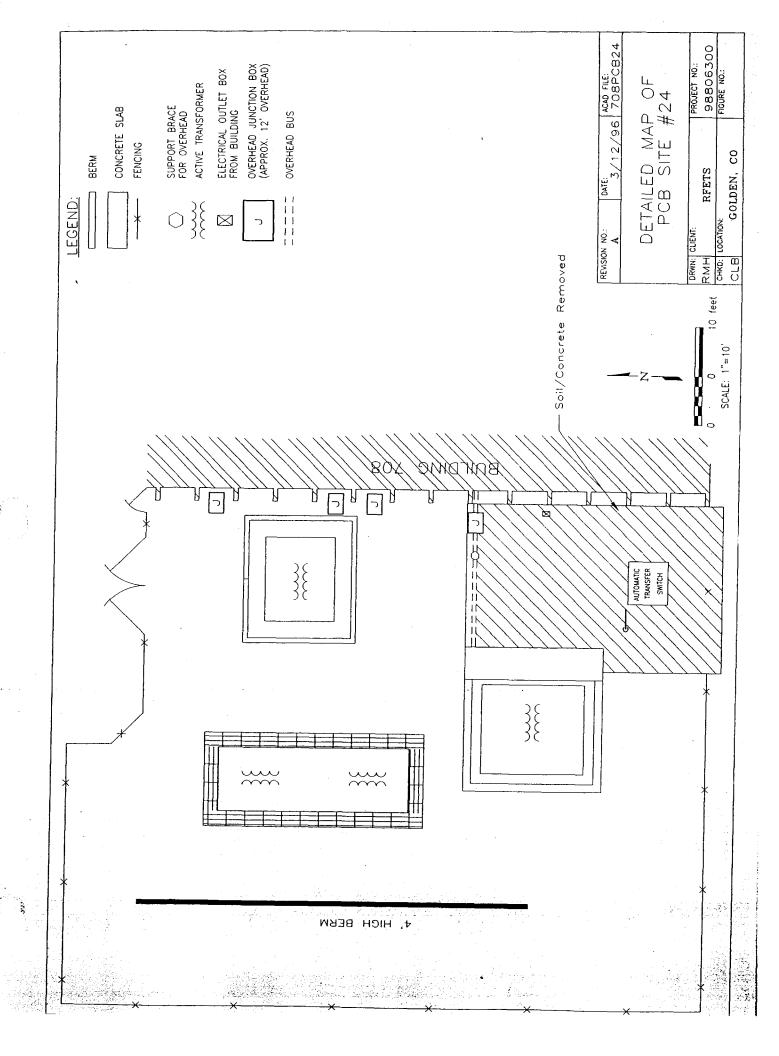


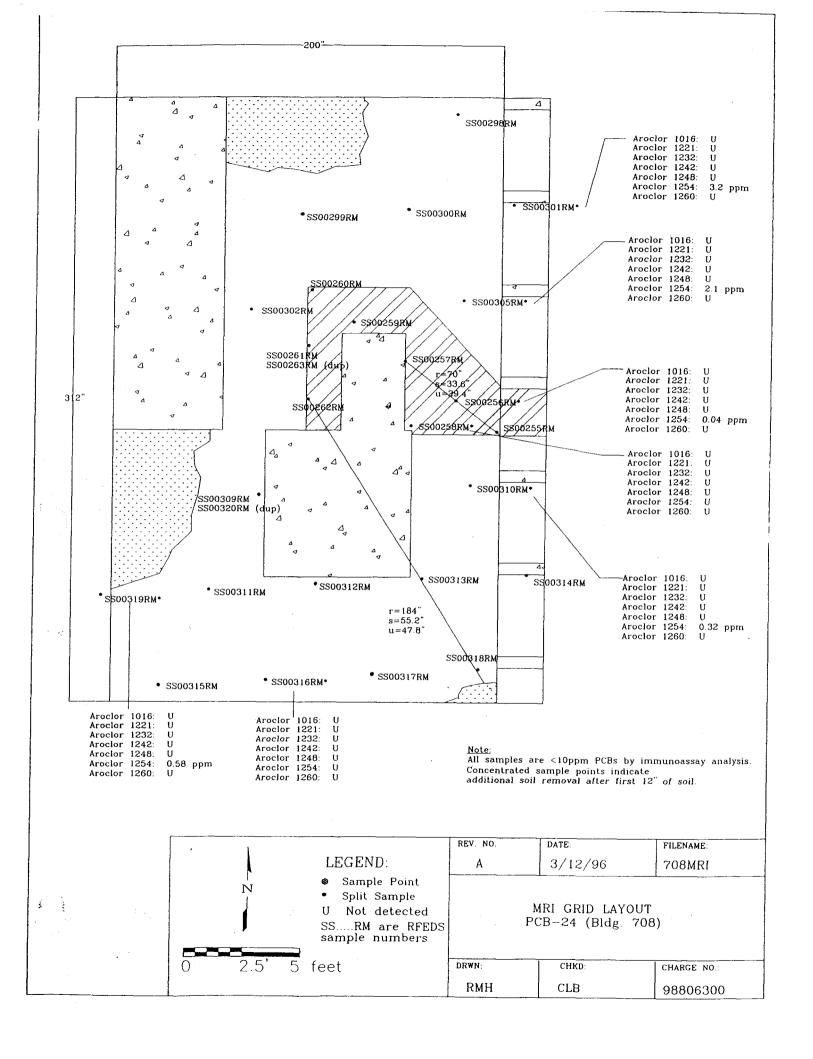


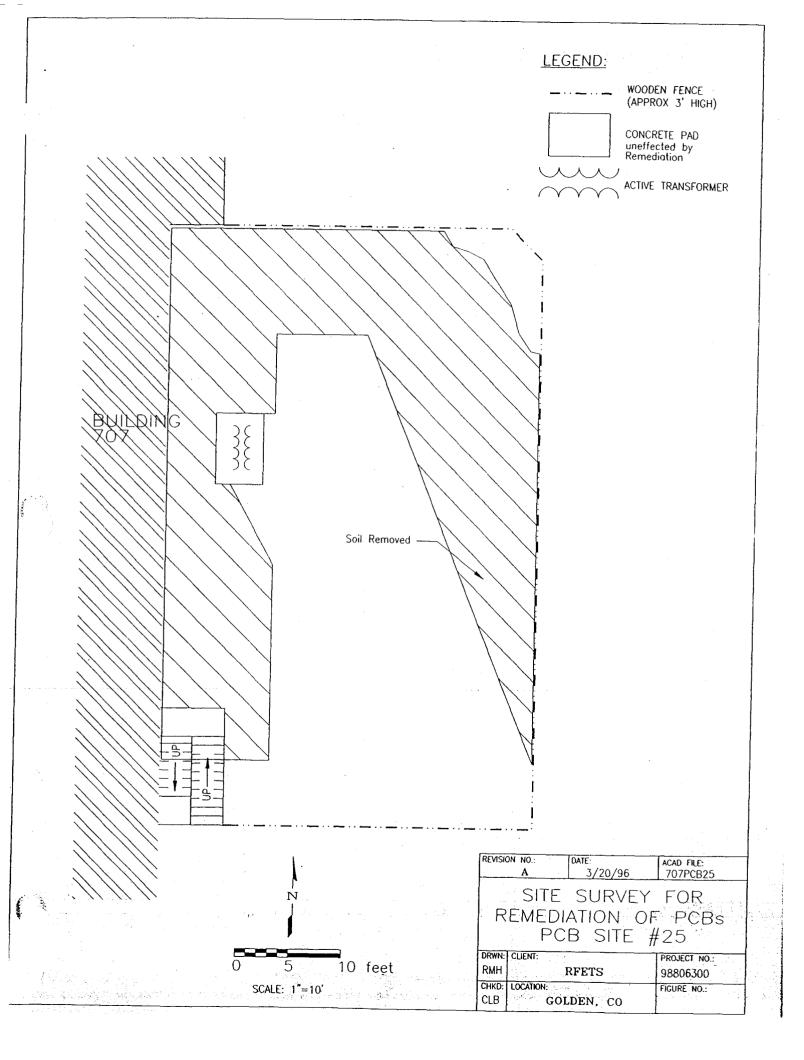


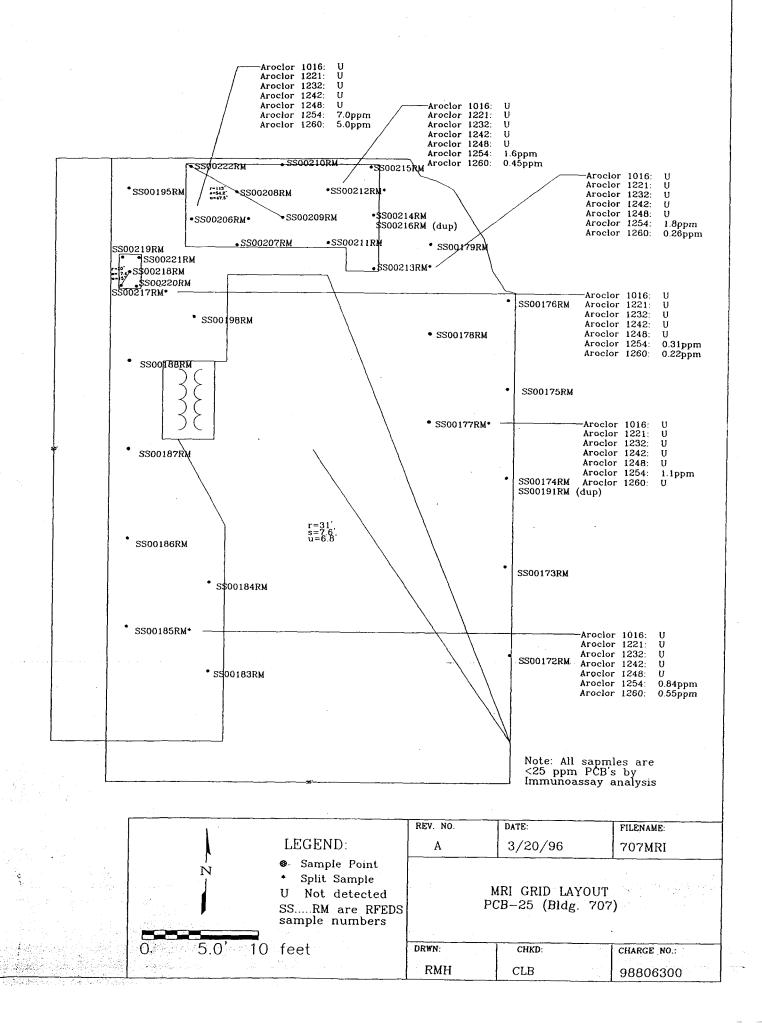
All Samlpes are <10 ppm PCB's by Immunoassay analysis

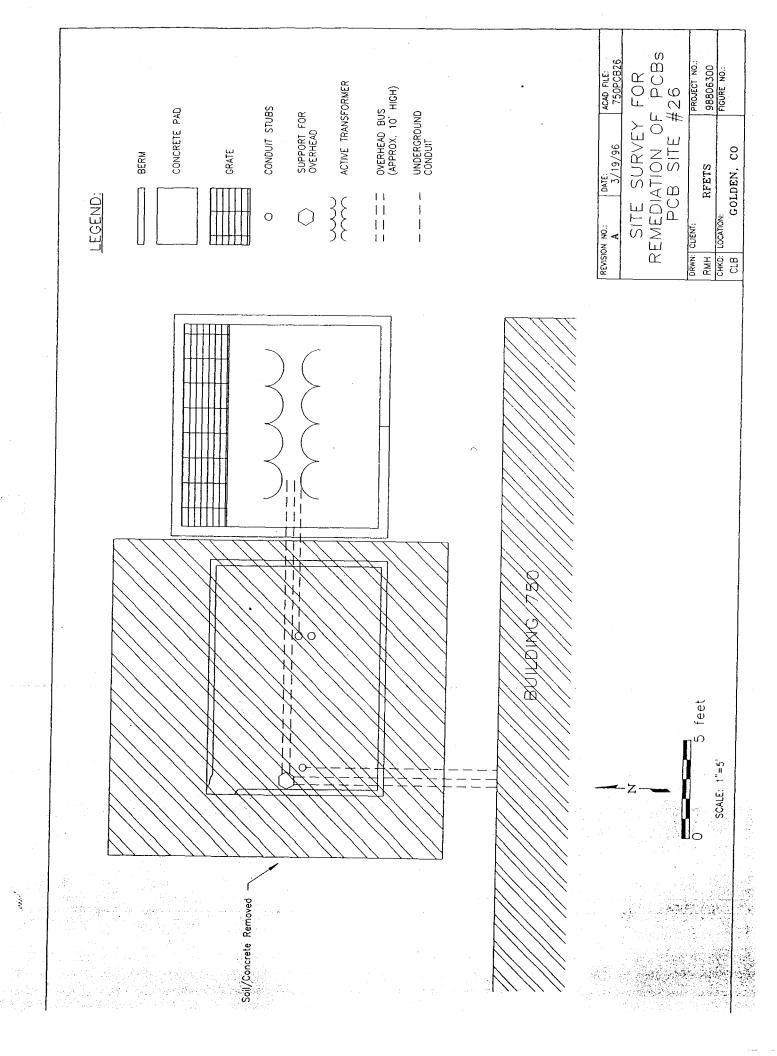
		REV. NO.	DATE:	FILENAME:
e ja	LEGEND:	A	3/14/96	559MRI
N	N Sample Point Split Sample U Not detected SSRM are RFEDS sample numbers		MRI GRID LAYOU PCB-23 (Bldg. 5	1 <b>T</b> 59)
0 2.5'	5 feet	DRWN: RMH	снко:	CHARGE NO.: 98806300

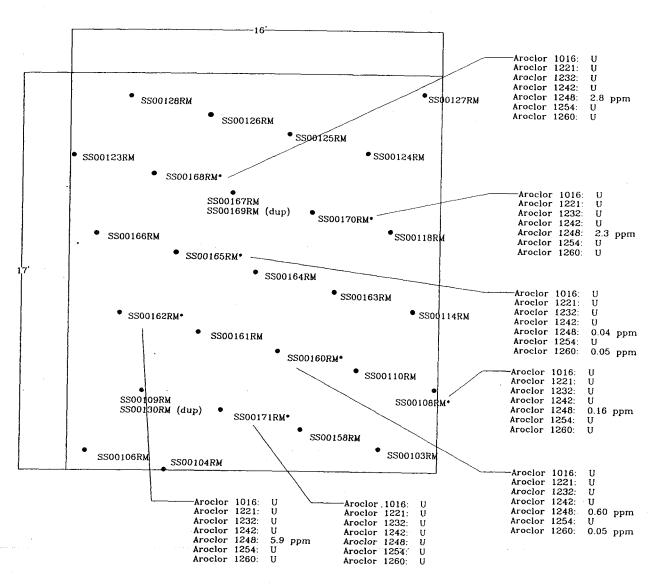




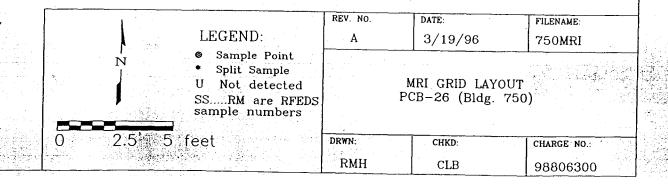


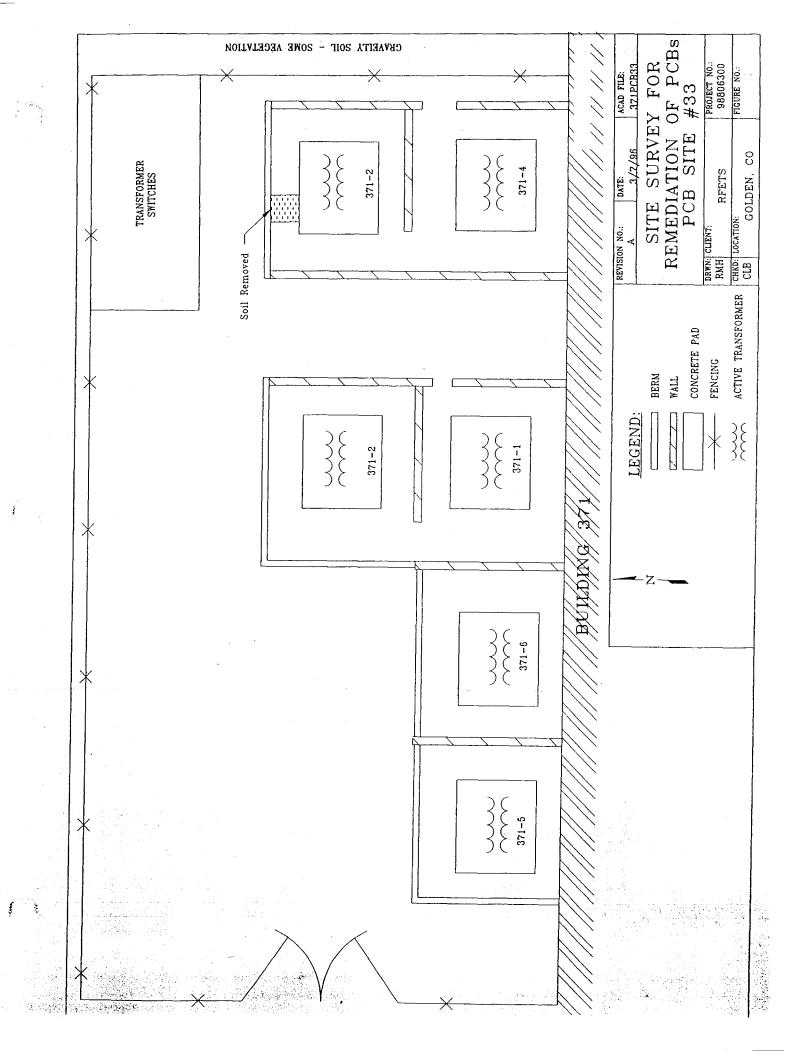


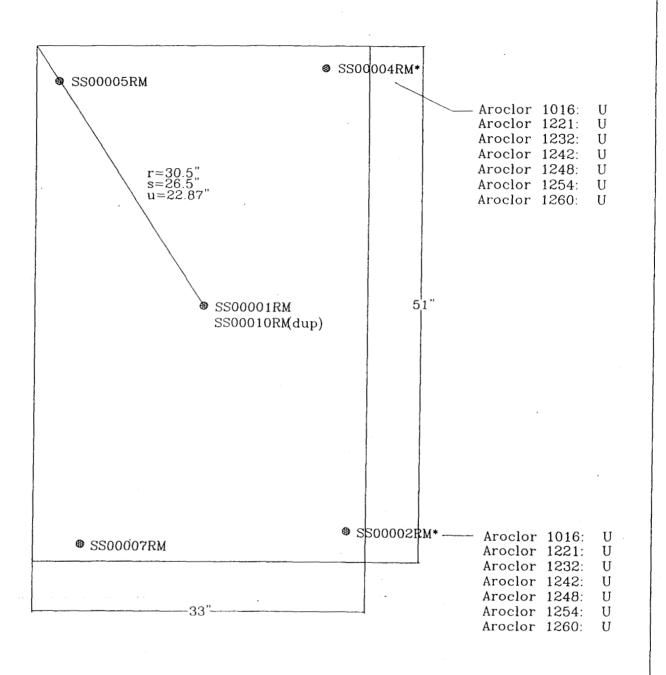




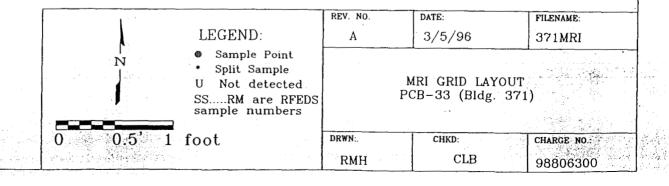
Note:
All samples are <10ppm PCBs by immunoassay analysis.

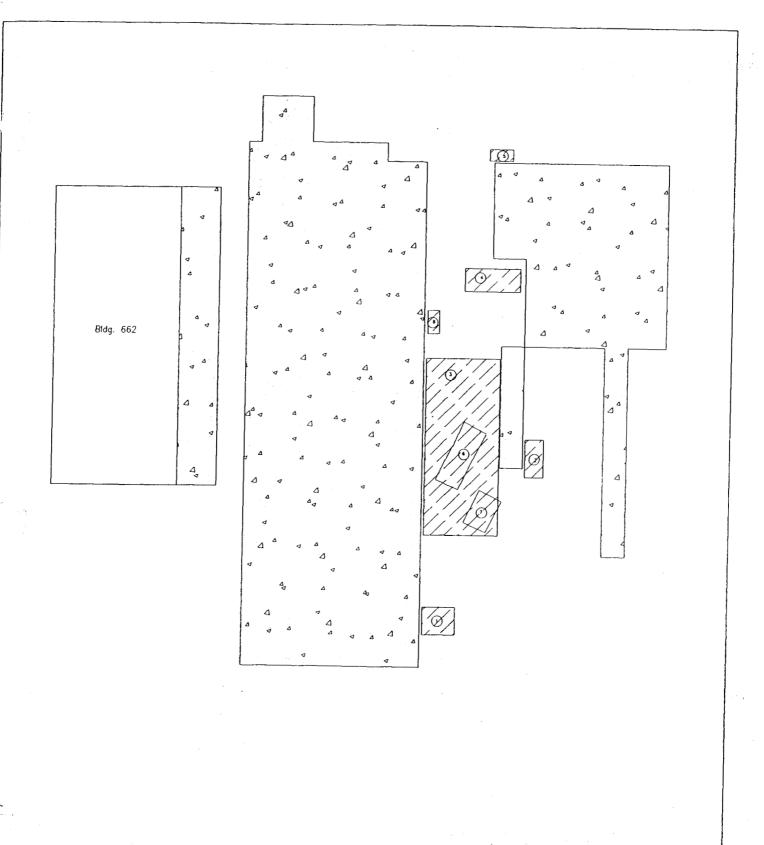


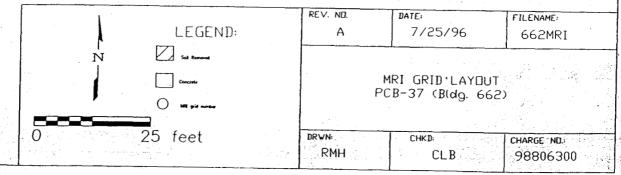


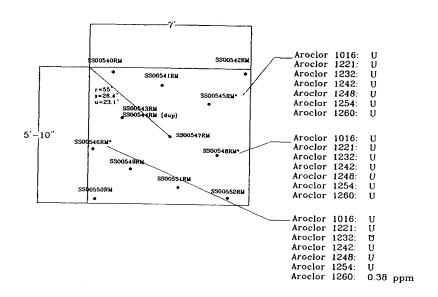


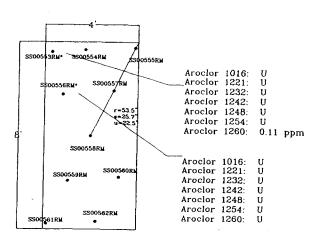
Note:
All samples are <10ppm PCBs by immunoassay analysis.



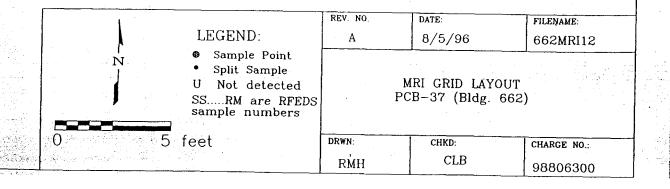


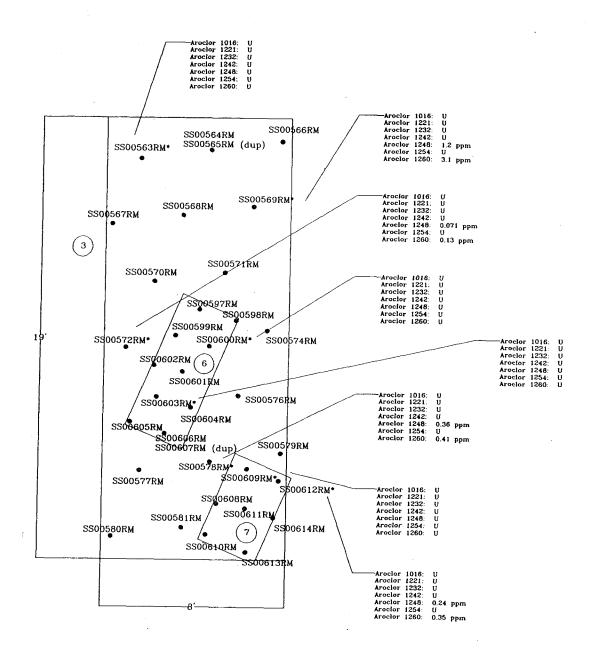




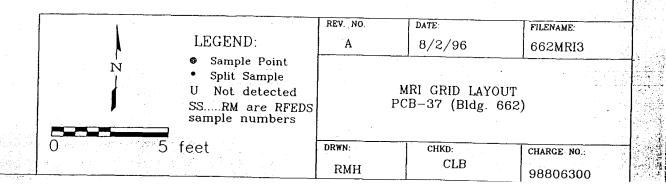


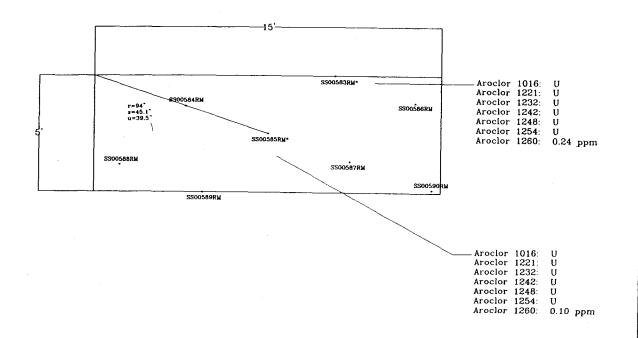
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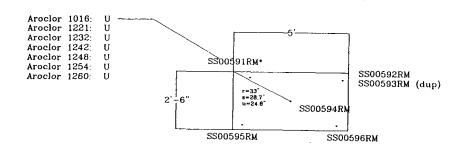




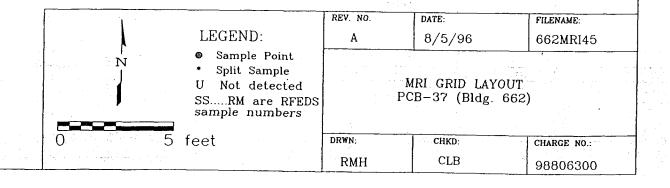
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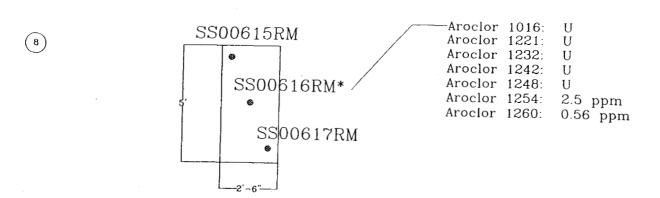




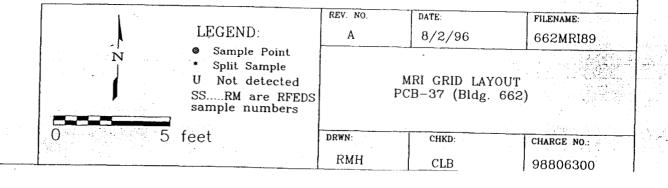


 $\underline{\underline{Note}}$ : All samples are <25ppm PCBs by immunoassay analysis.





 $\frac{Note.}{All \ samples \ are \ <25ppm \ PCBs \ by \ immunoassay \ analysis.}$ 



# Appendix B

### Method 8080 PCB Cleanup Verification Data



THE RESERVE AND THE PARTY OF TH



13715 Rider Trail North

Date 4-18-96	Earth City, MO 63045-1205
Number of pages including cover sheet	-: -
To: Ravecca	From: Barbara S. D.L.
Rocky Flato	
Phone 303-966-5756	Phone (314) 298-8566
Fax Phone 40 46	Fax Phone (314) 298-8757
CC:	
MARKS:	· ·
Urgent ©For your review	w Reply ASAP Please comment
MARKS:  Urgent SoFor your review  Data Summany Ja Login	w Reply ASAP Please comment
Data Summan Jos Login	w Reply ASAP Please comment
Data Summan Jos Login	w Reply ASAP Please comment
Data Summan Jos Login	w Reply ASAP Please comment
Urgent SoFor your review  Data Summany for login  Crossoziec  25  Crossoziec	w Reply ASAP Please comment
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Urgent SoFor your review  Data Summany for login  Crossories  25  Crossories  Les	89/4
Urgent SoFor your review  Data Summany for login  (Crossories   25  Crossories   28	89/4
Urgent Sofor your review  Data Summany for login  Crossoriff  Let  25  Crossoriff  Let  28	Reply ASAP Please comment
Urgent SoFor your review  Data Summany for login  Crossories  Crossories  25  Crossories  Las	Reply ASAP Please comment

# SOIL PCB MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: OUANTERRA, MO	Contract: 262.01
Lab Code: ITMO Case No.:	SAS No.: SDG No.: S1103
Matrix Spike -   EPA Sample	No.: CT00021EG Level: (low/med) Low
COMPOUND	SPIKE SAMPLE MS MS QC ADDED CONCENTRATION CONCENTRATION t LIMITS (ug/kg) (ug/kg) REC # REC.
Aroclor-1254_	0
COMPOUND	SPIKE MSD MSD ADDED CONCENTRATION t t QC LIMITS (ug/kg) (ug/kg) REC # RPD RPD REC.
Arodlor 1254	
# Column to be used to	flag recovery and RPD values with an asterisk
ND: Not determined	
:	outside limits out of outside limits
COMMENTS:	
	FORM III PEST-2

#### 4C PCB METHOD BLANK SUMMARY

Lab Name: QUANTERRA, MO	Contract: 262-01
Lab Code: ITMO Case No.:	SAS No.: SDG No.:_S1103
Lab Sample ID: BLK 73338	Lab Pile ID:
Matrix: (soil/water) SOLID	Level(low/med) <u>LOW</u>
Date Extracted: 07-22-95	Extraction: (SepF/Cont/Sonc) SONC
Date Analyzed (1): 07-24-95	Date Analyzed (2):07-24-95
Time Analyzed (1): 11:54	Time Analyzed (2):11:54
Instrument ID (1): GCA	Instrument ID (2): GCA
GC Column ID (1): <u>DB-608</u>	GC Column ID (2):DB-5MS

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	BPA	LAB	DATE	DATE
	SAMPLE NO.	SAMPLE ID	ANALYZED 1	ANALYZED 2
	250000000000000000000000000000000000000			4865555555
01,	PSPK01	SPK73338	_07-24-95_	_07-24-95_
02	CT00021EG	8914-001	_07-24-95_	07-24-95
03	CT00021EGMS_	8914-001MS	07-24-95	_07-24-95_
04	CT00021EGMSD	8914-001MSD	_07-24-95_	_07-24-95_
05	CT00022EG	8914-002	_07-24-95_	_07-24-95_
06	CT00023EG	8914-003	_07-24-95_	_07-24-95_
07	CT00024EG	8914-004	_07-24-95_	_07-24-95_
OR	CT00025EG	8914-005	_07-24-95_	_07-24-95_
09	CT00027EG	8914-006	_07-24-95_	_07-24-95_
10	CT00028EG	8914-007	_07-24-95_	_07-24-95_
11				
12				

COMMENTS:		
	<b>!</b>	

\_page <u>1</u> of <u>1</u>

PEST : - Re

• 00005

		rD ,			
PCB	ORGANICS	ANALYSIS	DATA	SHEET	

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract:	262-01 CT00021EG
Lab Code: ITMO Case No.: S	AS No.: SDG No.: _S1103 .
Matrix: (soil/water) SOIL	Lab Sample ID: 8914-001
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:
Level: (low/med) LOW	Date Sampled: 07-21-95
* Moisture: not dec dec	Date Extracted: 07-22-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 07-24-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/kg) UG/KG Q
12674-11-2Aroclor-1016	33 U_
11104-28-2Aroclor-1221	33 U
11141-16-5Aroclor-1232	
53469-21-9Aroclor-1242	33 U U
12672-29-6Aroclor-1248 11097-69-1Aroclor-1254	33 0 0
11097-69-1Aroclor-1254	33 U

U: Concentration of analyte is less than the value given.

PCB ORGANICS ANALYSIS DAT	A SHEET	EPA SAME	LE NO.
Lab Name: OUANTERRA, MO Contract: 262-01		CT00022	!EG
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	S1103	-
Matrix: (soil/water) SOIL Lab	Sample ID:	8914-	002
Sample wt/vol: 30.0 (g/ml) q Lab	File ID:		
Level: (low/med) LOW Date	Sampled:	07-21-95	<u> </u>
Moisture: not dec. dec. Date E	xtracted: _	07-22-95	<u> </u>
Extraction: (SepF/Cont/Song) SONC Date	Analyzed:	07-24-95	
GPC Cleanup: (Y/N) N pH: Dilu	tion Factor:	1	
CAS NO. Compound (ug/L or ug	ON UNITS: /Kg) <u>UG/KG</u>		Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	33 33 33 33 33 33 33		2 2 2 2 2 2 3
11098-82-5-1ALOCIOI-1200			

1D PCB ORGANICS ANALYSIS DATA SHEET EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262-01	CT00023EG
Lab Code: ITMO Case No.: SAS No.: SDG No.:	\$1103
Matrix: (soil/water) SOIL Lab Sample ID:	8914-003
Sample wt/vol: 30.0 (g/ml) g Lab File ID:	
Level: (Low/med) LOW Date Sampled:	07-21-95
% Moisture: not dec dec Date Extracted:	07-22-95
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	07-24-95
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 33	U
11104-28-2Aroclor-1221 33	, U
11141-16-5Aroclor-1232 33	i u
53469-21-9Aroclor-1242 33	U
12672-29-6Aroclor-1248	
11097-69-1Aroclor-125433	
11096-82-5Aroclor-126033	

U: Concentration of analyte is less than the value given.

PCB ORGANICS A	MALYSIS DATA SHEET	EPA SAMPLE NO.
Lab_Name: OUANTERRA,MO Contract: 2	62-01	CT00024EG
Lab Code: ITMO Case No.: SA	S No.: SDG No.:	S1103
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	8914~004
Sample wt/vol: 30.0 (g/ml) q	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	07-21-95
* Moisture: not dec dec	Date Extracted:	07-22-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	07-24-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
	CONCENTRATION UNITS:	
12674-11-2Aroglor-1016	33	U
11104-28-2Aroclor-1221	33	บ
11141-16-5Aroclor-1232	33	σ
53469-21-9Aroclor-1242	33	<u> </u>
12672-29-6Aroclor-1248_	33	
11097-69-1Aroclor-1254	47	

	}		i					
		PCB ORGANIC	1D S ANA	LYSIS DA	TA SHEET	,-	EPA SAI	MPLE NO.
Lab Name: OUAN	TERRA, MO	Contract:	262	-01			CT000:	25EG
Lab Code: ITMO	Case No.:		SAS	۸o.:	\$DG No	. :	: S1103	
Matrix: (soil/wa	er) SOIL			Lab	Sample ID:		8914	1-005
Sample wt/vol: _	30.0 (g/ml)			Lab	File ID:			·.
Level: (low/med	LOW	_	1	Date	e Sampled:		07-21-9	95
* Moisture: not d	ec	dec	<u> </u>	Date I	Extracted:		: 07-22-9	95
Extraction: (Sep	P/Cont/Sonc)	SONC		Date	analyzed:		07-24-9	95
GPC Cleanup: (Y/	N) N	рн:		Dilı	tion Factor	_	1	
CAS NO.	Compound				ion units: g/kg) <u>ug/kg</u>	-	-	۹.
12674-11-2 11104-28-2 11141-16-5 53469-21-9 12672-29-6 11097-69-1 11096-82-5	Aroclor-1221 Aroclor-1232 Aroclor-1242 Aroclor-1248 Aroclor-1254				33 33 33 33 33 33 33			0 0 0 0 0 0 0

1D PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: <u>QUANTERRA,MO</u> Contract:	262-01	CT00027EG
Lab Code: 'ITMO Case No.:	SAS No.: SDG No.:	S1103 .
Matrix: (soil/water) SOIL	Lab Sample ID:	8914-006
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	07-21-95
% Moisture: not dec dec	Date Extracted:	07-22-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	07-24-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	33 33 33 33 33 33 230	0 0 0 0

U: Concentration of analyte is less than the value given.

	PCB ORGANIC	1D S ANALYSIS DA	TA SHEET	EPA SAMPLI	E NO.
Lab Name: OUANTERRA, MO	Contract:	262-01		CT000Z8E	3
Lab Code: ITMO Case No.:		SAS No.:	SDG No.:	S1103	
Matrix: (soil/water) SOIL		Lab	Sample ID:	8914-00	07
Sample wt/vol: 30.0 (g/ml)	g	Lab	File ID:		
Level: (low/med) LOW	_	Dat	e Sampled:	07-21-95	
Moisture: not dec	dec	Date	Extracted:	07-22-95	
Extraction: (SepF/Cont/Sonc)	SONC	Dat	e Analyzed:	07-24-95	
GPC Cleanup: (Y/N) N	рн:	Dil	ution Factor:	1	
CAS NO. Compound		CONCENTRAT	ION UNITS: g/Kg) UG/KG	·	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5			33 33 33 33 33 33 33 430		ช ช ช ช ช ช

## SOIL PCB SPIKE BLANK (LCS) RECOVERY

Lab Name: OUANTERRA, MO		Contra	ct:	262.01		
Lab Code: ITMO Case No.:		SAS No.:	SDG No.	<u> 51103</u>		
Spike Blank No.: SPK	73338		-			•
COMPOUND	SPIKE ADDED (ug/Kg)	SPIKE CONCENTRATION (ug/kg)	REC #			
Aroclor-1254	170	120	74	29-131		
•		•	,	1		
# Column to be used to flag	; recovery	and RPD values	with a	ın asteri	sk	
* Values outside of QC limi	ts					
ND: not determined				; . \	•	
Spike Recovery: 00	out of	_1outside	e limits	, )		
COMMENTS:						

FORM III PEST-2

2F PCB SURROGATE RECOVERY

Lab	Name: OUAN	TERRA, MO	Contract: 262-0	1
Lab	Code: ITMO	Case No.:	SAS No.: SDG No.:_S	1103

Level: (low/med) LOW

	EPA	\$1	\$2
	SAMPLE NO.	(DBC)#	(TCMX)#
	==========	2====	222222
01	PBLK01	61	90
02	PSPK01	64	93
03	CT00021EG	46	125
04	CT00021EGMS	71	180
05	CT00021EGMSD	44	
06	CT00022EG	49	119
07	CT00023EG	52	113
80	CT00024EG	54	118
09	CT00025EG	26	90
10	CT00027EG	40	99
11	CT00028EG	33	91
12			
13			
14			
15			

ADVISORY

S1 (DBC) = Dibutylchlorendate S2 (TCMX) = Tetrachlorom-m-xylene

( D-165) ( D-267)

# Column to be used to flag recovery values

\* Values outside of QC limits

D Surrogates diluted out

page <u>l</u> of 1

FORM II PEST-2

1/87 Rev.

00002

PCB ORGANIO	1D S ANALYSIS DATA SHEET	epa gample no.
Lab Name: QUANTERRA.MO Contract:	262-01	CT00037RM
Lab Code: ITHO Case No.:	EAR NO.1 SDC NO.1	51170
Matrix: (soil/water) SOIL	Lab Sample ID:	10048-001
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:	
Level: (low/med) Low	Date Sampled:	12-22-95
% Moisture: not dec dec	Date Extracted:	01-03-96
Extraction: (Sepf/Cont/Sonc) <u>SONC</u>	Date Analyzed:	01-08-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2	24	Ū
11104-28-2Aroclar-1221	34	
11141-16-5Aroclor-1232	34	ש
53469-21-9Aroclor-1242	34	U
12672-29-6	34	<u> </u>
11097-69-1		
11084-87-3	34	U

S 35 8	3/4	200	***	200	4.5
SH . 3	20	4.4		4	1
		6.5	4	18.12	
		10.3		V 1	
		200			

ውስያ ለዕለችነ	1D [CS ANALYSIS DATA SHRET	EPA SAMPLE NO.
	_	CT00038RH
Lab Name: <u>QUANTERRA_MO</u> Contract:	262-01	
Lab Code: ITMO Case No.:	BAS No.: SDG No.:	61170
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	10048-002
Sample wt/vol: 30.0 (g/ml) q	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	12-22-95
% Holsture: not dec. 6 dec.	Date Extracted:	01-03-96
Extraction: (SepF/Cont/Sonc)		
GPC Cleanup: (Y/N) N pH:	Dilution Pactor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) Ug/Kg	Q
12674-11-2Aroclor-1016	36	U
11104-28-2Aroclor-1221	36	
11141-16-5Aroclor-1232	36	U
53469-21-9Aroclor-1242	36	<u> </u>
12672-29-6Aroclor-1248	36	T T
11097-69-1Aroclor-1254_	36	
11096-82-5Aroclor-1260	36	

1000 C

10 POB ORÇANICS ANALYSIS DATA SHEET	epa sample no.
Lab Name: QUANTERRA, MO Contract: 262-01	CT00039RH
Lab Code: ITMO Case No.: SDG No.: SDG No.	: _61170
Hatrix: (soil/water) Lab Sample ID:	10048-003
Sample wt/vol: 30.1 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	12-22-95
% Moisture: not dec. 6 dec. Date Extracted:	01-03-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	01-08-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	11
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 35 11104-28-2Aroclor-1221 35 11141-16-5Aroclor-1232 35 53469-21-9	7 7 7 2
11097-69-1	

U: Concentration of analyte is less than the value given.

PCE ORGANI	ID ICS AMALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Namo: <u>QUANTERRA, MO</u> Contract:	26201	CT00040RM
Lab Code: ITHO Case No.:	SAS NO.: 5DG NO.:	81170
Matrix: (soil/water) SOIL	Lab Sample ID:	10048-004
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	12-22-95
Moisture: not dec. 4 dec	Date Extracted: _	01-03-96
Extraction: (SepF/Cont/Sono) <u>SONC</u>	Date Analyzed:	01-08-96
GPC Cleanup: (Y/N) N pH:	Dilution Faqtor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg), Ug/Kg	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221	35 38	
11141-16-5Aroclor-1232 53469-21-9Aroglor-1242	3535	<u> </u>
12672-29-6	35	
11097-69-1Aroclar-1254	35	<u> </u>
11096-82-5Aroolor-1260	35	0

1d PCB ORGANICS ANALYSI	S DATA SHEET	EPA SAMPLE NO.
Lab Name: QUANTERRA, MO Contract: 262-01		CT00041RK
Lab Code: ITHO Case No.: 5AS No.:	SDG No.:	61170
Hatrix: (soil/water) SOIL	Lab Sample ID:	10048-005
Sample wt/vol: 30.2 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	12-22-95
t Moisture: not dec. 4 dec. n	ate Extracted:	01-03-96
Extraction: (SapF/Cont/Sonc) SQNC	Date Analysed:	01-08-96
GPC Cleanup: (Y/N) N pff:	Dilution Factor:	1
	TRATION UNITS: or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016	34	0
11104-28-2Aroclor-1221	34	
11141-16-5	34	
12672-29-6Arador-1242		
11097-69-1Aroclor-1254	34	<del></del>
11096-82-5Aroclor-1260	34	

A SHEET	EPA SAMPLE NO.
	CT00042RK
SDG No.:	81170
Sample ID:	10048-006
Pile ID:	
Sampled:	12-22-95
ctracted: _	01-03-96
Analyzed:	01-08-96
tion Pactor:	1
ON UNITS: /Kg) UG/KG	Q
34 34 34 34 34 34 34 34	0 0 0 0 0 0
	SDG No.:  Bample ID:  File ID:  Sampled:  Analyzed:  tion Factor:  ON UNITS:  /Kg) UG/KG  34  34  34  34  34  34

PCB ORGANIC	ID OS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA,MO Contract:	262.01	CT00076RM
Lab Code: ITMO Case No.:	SAS No.: SDC No.:	51180
Matrix: (Boil/water) SOIL	Lab Sample ID: _	10311-001
Sample wt/vol: 15.09 (g/ml) q	Lab File ID:	·
Level: (low/med) LOW	Date Sampled:	02-05-96
% Moisture: not dec. 3.32 dec.	Date Extracted:	02-12-96
Extraction: (SepF/Cont/Sonc)SEF	P Date Analyzed:	02-13-96
GPG Oleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/kg) UG/KG	Q
12674-11-2Aroclor-1016	33	ū
11104-28-2Aroclor-1221_	33	
11141-16-5Aroclor-1232	33	
53469-21-9Arodlor-1242	33	
12672-29-6		<del></del>
11096-82-5Aroclor-1260	86	
1 11010101 1100101		

, PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA.MO Contract: 262.01	CT00081RK
Lab Code: ITMO Case No.: SAS No.: SDC No.:	81180
Matrix: (soil/water) Lab Sample ID:	10311-002
Sample wt/vol: 15.12 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-05-96
% Moisture: not dec dec Date Extracted:	02-12-96
Extraction: (SepF/Cont/Sonc)SEPF Data Analyzed:	02-13-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/Kg)_UG/KG	_ Q
12674-11-2Aroslor-1016 33 11104-28-2	
11141-16-5Aroclor-1232 33 53469-21-9Aroclor-1242 33	<u> </u>
12672-29-6Arodlor-1248 33	<del></del>
11097-69-1Aroclor-1254 33	
11096-82-5Aroclor-1260 33	



## PCB RESULTS

	Aroclor						
Sample ID	1016	1221	1232	1242	1248	1254	1260
QCBLK73293	33 U						
CT00001EG	33 U						
CT00002EG	33 U	100					
CT00003EG	33 U	33 U	33 U	33 U	33000 U	33000 U	56000
CT00004EG	33 U	33 ป	41				
CT00005EG	33 U						
CT00006EG	33 U						
CT00007EG	33 U						
CT00008EG	33 U						
CT00009EG	33 U						
CT00010EG	33 U						
CT00011EG	33 U						
CT00012EG	33 U	33 U	33 U	.33	33 U	33 U	33 U
CT00013EG	33 U						
CT00014EG	33 U	33 U	33 U	120	33 U	33 U	33 U
CT00015EG	33 U	33 U	33 U	130	33 U	33 U	33 U
CT00016EG	33 U	33 U	33 U	33 U	2500	980	130
CT00017EG	33 U	120					
CT00018EG	33 U						
CT00019EG	33 U						
CT00020EG	33 U						

U: Undetected at stated detection limit



To: Wayne Sprolles/Nick Demos

Fax Number: (303) 966-8704 Phone Number: (303) 966-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

## PCB RESULTS

Lab (D 155	Sample ID 8.37	Aroclor 1016	Aroclor	Aroclor	4.4	the state of the s		Aroclor
QCBLK76880	QCBLK76880	33 U	33 U	33 U	1242 33 U	1248 33 U	1254 33 U	1260
9229-001	CT00029EG	34 U	34 U	34 U	210	34 U	34 U	33 U
9229-002	CT00030EG	34 U	34 U	34 U	1300	34 U	34 U	34 U
9229-003	CT00031EG	34 U	34 U	34 U	210	34 U	34 U	34 U
9229-004	CT00032EG	34 U	34 U	34 U	34 U	34 U	34 U	34 U
9229-005	CT00033EG	34 U	34 U	34 U	34 U	34 U	34 U	34 U
9229-006	CT00034EG	34 U	34 U	34 U	34 U	34 U	34 U	34 U
9229-007	CT00035EG	34 U	34 U	34 U	730	34 U	34 U	34 U
9229-008	CT00036EG	; 34 U	34 U	34 U	860	34 U	34 U	34 U
9229-001MS	CT000029EG MS	34 U	34 U	34 U	270	34 U	107% Rec	34 U
9229-001MSD	CT000029EG-MS	37 U	37 U	37 U	260	37 U	97% Rec	37 U

U: Not detected at the detection limit stated

PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

CT00051RM

Lab Name: QUANTERRA, MO Contract:	_262-01	
Lab Code: ITMO Case No.:	SAS No.: SDG No.: _S1171_	
Matrix: (soil/water) SOIL	Lab Sample ID:101	23-002
Sample wt/vol: 15.0 (g/ml) G	Lab File ID:	
Level: (low/med) LOW	Date Sampled: 01-09-	96
* Moisture: not dec3dec	Date Extracted: 01-11-	96
Extraction: (SepF/Cont/Song) SONC	Date Analyzed: 01-16-	96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 0	,5
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg)_UG/KG	Q
12674-11-2Aroclor-1016	34	U U
11104-28-2Aroclor-1221	34	<del>0</del>
\$3469-21-9Aroclor-1242	34	
12672-29-6Aroclor-1248	34	<u></u>
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34	u

1D PCB ORGANICS ANALYSIS DA	TA SHERT	EPA SAMPLE	NO.
Lab Name: OUANTERRA.MO Contract: 262-01		CT00052RM	
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	S1171	
Matrix: (soil/water) SOIL Lab	Sample ID:	10123-00	2
Sample wt/vol: 30.0 (g/ml) G Lab	File ID:		
Level: (low/med) LOW Date	e Sampled:	01-09-96	
* Moisture: not dec. 2 dec. Date	Extracted:	01-11-96	
Extraction: (SepF/Cont/Sono) SONC Date	e Analyzed:	01-16-96	
GPC Cleanup: (Y/N) N PH: Dilu	ution Factor: _	1.0	
CAS NO. Compound (ug/L or ug	ION UNITS: g/Kg) <u>UG/KG</u>	Q	!
12674-11-2Aroalor-1016 11104-28-2Aroalor-1221 11141-16-5Aroalor-1232 53469-21-9Aroalor-1242 12672-29-6Aroalor-1248	34 34 34 34 34	0	
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34 34		

PCH ORGANI	ID OS ANALYSIS DATA SHEET	EPA SAMPLE NO.
ab Name: OUANTERRA,MO Contract:	262-01	CT00053RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	\$1171
Matrix: (soil/water) SOIL	Lab Sample ID:	10123-003 .
Sample wt/vol: 30.0 (g/ml) G	Lab File ID:	
evel: (low/med) LOW	Date Sampled:	01-09-96
Moisture: not dec. 2 dec.	Date Extracted:	01-11-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	01-16-96
SPC Cleanup: (Y/N) N pii:	Dilution Factor:	1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Eg)_UG/EG	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6	34 34 34 34 34 34 34 34	0 0 0 0
**************************************		

Lab Name: OUANTERRA.MO Contract: 262-01  Lab Code: ITMO Case No.: SAS No.: SDG No.: S1171  Matrix: (soil/water) SQIL Lab Sample ID: 10123-004  Sample wt/vol: 30.0 (g/ml) 3 Lab File ID:  Level: (low/med) LOW Date Sampled: 01-09-96  t Moisture: not dec. 2 dec. Date Extracted: 01-11-96  Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01-16-96  GPC Cleanup: (Y/N) N PH: Dilution Factor: 1.0  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q  12674-11-2Aroclor-1016 34 U  11104-28-2Aroclor-1221 34 U  11141-16-5Aroclor-1232 34 U  12672-29-6Aroclor-1242 34 U  12672-29-6Aroclor-1248 34 U  11097-69-1	PCB ORGANICS ANALYSIS D	ATA SHEET	EPA SAMPLE NO.
Matrix: (soil/water) <u>SOIL</u> Lab Sample ID: 10123-004  Sample wt/vol: <u>30.0</u> (g/ml) <u>G</u> Lab File ID:  Level: (low/med) <u>LOW</u> Date Sampled: 01-09-96  * Moisture: not dec. <u>7</u> dec. Date Extracted: 01-11-96  Extraction: (SepF/Cont/Sonc) <u>SONC</u> Date Analyzed: 01-16-96  GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.0  CONCENTRATION UNITS: (ug/L or ug/kg) <u>UG/KG</u> Q  12674-11-2Aroclor-1221 34 U  11104-28-2Aroclor-1221 34 U  11141-16-5Aroclor-1222 34 U  53469-21-9Aroclor-1242 34 U  12672-29-6	Lab Name: OUANTERRA.MO Contract: 262-01		CT00054RM
Sample wt/vol: 30.0 (g/ml) G       Lab File ID:         Level: (low/med) LOW       Date Sampled: 01-09-96         t Moisture: not dec. 2       dec. Date Extracted: 01-11-96         Extraction: (SepF/Cont/Sonc)       SONC Date Analyzed: 01-16-96         GPC Cleanup: (Y/N) N PH: Dilution Factor: 1.0       CONCENTRATION UNITS: (ug/L or ug/kg) UG/kg       Q         CAS NO. Compound       CONCENTRATION UNITS: (ug/L or ug/kg) UG/kg       Q         12674-11-2Aroclor-1221 34 U       34 U       U         11141-16-S	Lab Code: ITMO Case No.: SAS No.:	SDG No.:	81171
Level: (low/med) LOW Date Sampled: 01-09-96  * Moisture: not dec. 2 dec. Date Extracted: 01-11-96  Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01-16-96  GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.0  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q  12674-11-2Aroclor-1016 34 U  11104-28-2Aroclor-1221 34 U  11141-16-5Aroclor-1232 34 U  12672-19Aroclor-1242 34 U  12672-29-6Aroclor-1248 34 U  11097-69-1Aroclor-1254 34 U	Matrix: (soil/water) SOIL La	b Sample ID:	10123-004
# Moisture: not dec.	Sample wt/vol: 30.0 (g/ml) 3 Lal	b File ID:	
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 01-16-96  GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.0  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q  12674-11-2Aroclor-1016 34 U  11104-28-2Aroclor-1221 34 U  11141-16-5Aroclor-1232 34 U  12672-29-6Aroclor-1242 34 U  12672-29-6Aroclor-1248 34 U  11097-69-1Aroclor-1254 34 U	Level: (low/med) LOW Date	te Sampled:	01-09-96
GPC Cleanup: (Y/N) N pH: Dilution Factor: 1.0  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q  12674-11-2Aroclor-1016 34 U 11104-28-2Aroclor-1221 34 U 11141-16-5Aroclor-1232 34 U 12672-19Aroclor-1242 34 U 12672-29-6Aroclor-1248 34 U 11097-69-1Aroclor-1254 34 U	* Moisture: not dec. 2 dec. Date	Extracted:	01-11-96
CONCENTRATION UNITS: (ug/L or ug/kg) Ug/kg Q  12674-11-2	Extraction: (SepF/Cont/Sonc) SONC Date	te Analyzed:	01-16-96
CAS NO.     Compound     (ug/L or ug/Kg) UG/KG     Q       12674-11-2Aroglor-1016     34     U       11104-28-2Aroglor-1221     34     U       11141-16-5Aroglor-1232     34     U       53469-21-9Aroglor-1242     34     U       12672-29-6Aroglor-1248     34     U       11097-69-1Aroglor-1254     34     U	GPC Cleanup: (Y/N) N pH: D3.	lution Factor:	1.0
11104-28-2Aroglor-1221     34     U       11141-16-5Aroglor-1232     34     U       53469-21-9Aroglor-1242     34     U       12672-29-6Aroglor-1248     34     U       11097-69-1Aroglor-1254     34     U			Ω.
	11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248	34 34 34 34 34	n n n
11090-62-9	11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34	

PCE ORGANICS ANALYSIS D	ATA SHEET	RPA SAMPLE NO.
ab Name: OUANTERRA,MO Combmadt: 262-01		CT00055RM
ab Code: ITMO Case No.: SAS No.:	SDG No.:	\$1171
Matrix: (soil/water) <u>SOIL</u> La	b Sample ID:	10123-005
Sample wt/vol: 30.1 (g/ml) G La	b File ID:	
evel: (low/med) LOW Da	te Sampled:	01-09-96
Moisture: not dec Date	Extracted:	01-11-96
extraction: (SepF/Cont/Sonc) SONC Da	te Analyzed:	01-16-96
JPC Cleanup: (Y/N) N pH: Di	lution Factor: _	1.0
	TION UNITS: ug/Kg) <u>UG/KG</u>	Q
12674-11-2Aroclór-1016 11104-28-2Aroclor-1221 11141-16-5	36 36 36 36 36 36	0 0 0
11096-82-5Aroclor-1260	150	

PCB ORGANICS AMALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-01	CT00056RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	\$1171
Matrix: (soil/water) <u>SOIL</u> Lab Sample ID:	10123-006
Sample wt/vol: 30.0 (g/ml) G Lab File ID:	·
Level: (low/med) LOW Date Sampled:	01-09-96
* Moisture: not dec Date Extracted:	01-11-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1.0
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q .
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 34 11141-16-5Aroclor-1232 34 53469-21-9Aroclor-1242 34 34 34 34 34	0 0 0 0
12672-29-6Arodlor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	

1D PCB ORGANICS AN	ALYSIS DATA SHEET EPA SAMPLE NO.
Lab Name: OUANTERRA MO Contract: 26	2-01 CT00057RM
Lab Code: ITMO Case No.: SAS	No.: SDG No.: _S1171
Matrix: (soil/water) _SOIL	Lab Sample ID: 10123-007
Sample wt/vol: 30.0 (g/ml) G	Lab File ID:
Level: (low/med) LOW	Date Sampled: 01-09-96
* Moisture: not dec. 3 dec.	Date Extracted: 01-11-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 1.0
· · · · · · · · · · · · · · · · · · ·	ONCENTRATION UNITS: ug/L or ug/Kg) UG/KG Q
12674-11-2Aroglor-1016	34U
11104-28-2Aroclor-1221	34 U
11141-16-5Aroolor-1232_	34 U
53469-21-9Aroclor-1242	34 U
12672-29-6Aroclor-1248	200
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	SD
SD: See dilution. Ut Concentration of analyte is less than t	he value given.

PCE ORGANICS ANAL	YSIS DATA SEEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-	01	CT00057RM
Lab Code: ITMO Case No.: SAS N	To.: SDG No.:	S1171
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	10123-007
Sample wt/vol: 30.0 (g/ml) G	Lab Pile ID:	
Level: (low/med) LOW	Date Sampled:	01-09-96
t Moisture: not dec. 3 dec	Date Extracted: _	01-11-96
Extraction: (Sep#/Cont/Sono) SCNC	Date Analyzed:	01-19-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	10
	CENTRATION UNITS:	Q
12674-11-2Aroolor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	340 340 340 340 340 340 1200	a a a a a a a a a a a a a a a a a a a
11030-02-3		

PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

PCB ORGANIC	S ANALISIS DATA SHEET	
Lab Name: <u>OUANTERRA, MO</u> Contract:	262-01	CT00058RM
Lab Code: ITMO Case No.:		S1171
Matrix: (soil/water) SOIL	Lab Sample ID:	
Sample wt/vol: 30.0 (g/ml) G	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	01-09-96
* Moisture: not dec. 2 dec.	Date Extracted:	01-11-96
Extraction: (SepF/Cont/Sond) SONC	Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) <u>UG/KG</u>	Q
12674-11-2Aroglor-1016	34	
11104-28-2Arodlor-1221		u
11141-16-5Aroclor-1232	34	U
53469-21-9Aroclor-1242	34	
11097-69-1Aroclor-1254		
11096-82-5Aroclor-1260	34	
	. <u> </u>	

U: Concentration of analyte is less than the value given.

PCB ORGA	1D NICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA MO Contract	t: <u>262-01</u>	CT00059RM
Lab Code: ITMO Case No.:	_ SAS No.: SDG No.:	\$1171
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID: _	10123-009
Sample wt/vol: 30.0 (g/ml) G	Lab File ID:	
Level: (low/mad) LOW	Date Sampled:	01-09-96
* Moisture: not dec. 2 dec.	Date Extracted:	01-11-96
Extraction: (SepF/Cont/Sonc) SON		
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg)_UG/KG	Q
12674-11-2Aroglor-1016	34	U
11104-28-2Aroclor-1221 11141-16-5Aroclor-1232	34	
53469-21-9Aroclor-1242	34	U
12672-29-6Aroclor-1248	34	U
11097-69-1Aroclor-1254	34	

	PCB ORGANIC	S ANALYSIS DATA SHEBT	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO	Contract:	262-01	CT00060RM
Lab Code: ITMO Case No.:		SAS No.: SDG No.:	61171
Hacrike (GOII/Water) SOIL		Lab Sample ID:	
Sample wt/vol: _30.0 (g/ml)	G	Lab File ID:	
Level: (low/med) LOW		Date Sampled:	01-09-96
Moisture: not dec. 2		Date Extracted:	
Extraction: (SepF/Cont/Sonc)		Date Analyzed:	
GPC Cleanup: (Y/N) <u>H</u>	pH:	Dilution Factor:	
CAS NO. Compound	•	CONCENTRATION UNITS:	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5		34 34 34 34 34 34 34 34	

FORM I PRST

Concentration of analyte is less than the value given.

1D
PCR ORGANICS ANALYSIS DATA SUPER

EPA SAMPLE NO.

PCI	B ORGANICS ANALYSIS D	ata shert	
Lab Name: OUANTERRA, MO Co	ontract: <u>262-01</u>		CT00061RM
Lab Code: ITMO Case No.:	SAS No.:	SDG No.: _	S1171
Matrix: (soil/water) SOIL	Lei	Sample ID:	10123-011
Sample wc/vol: 30.1 (g/ml)_	G Lal	File ID:	
Level: (low/med) LOW	Dat	e Sampled:	01-09-96
* Moisture: not dec. 3 de	Date	Extracted:	01-11-96
Extraction: (SepF/Cont/Sonc)	SONC Date	e Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH	Hr Dil	ution Factor: _	1.0
CAS NO. Compound	CONCENTRAT		_ Q .
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1		34 34 34 34 34 34 34	0 0 0 0

U: Concentration of analyte is less than the value given.

PORM I PRST

PCB ORGANICS AMALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA.MO Contract: 262-01	CT00062RM
Lab Code: ITMO Case No.: SDG No.: SDG No.:	: <u>\$1171</u>
Matrix: (soil/water) SOIL Lab Sample ID:	10123-012
Sample wt/vol: 30.2 (g/ml) G Lab File ID:	
Level: (low/med) LOW Date Sampled:	01-09-96
Moisture: not ded. 3 ded. Date Extracted:	01-15-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	
GPC Cleanup: (Y/N) N pH: Dilution Factor:	
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Arodlor-1016 34	<u>u</u>
11104-28-2Arodlor-1221 34 11141-16-5Arodlor-1232 34	
53469-21-9Arodlor-124234	<del></del>
12672-29-6Aroclor-1248 34	- J - U
11097-69-1Aroalor-125434	
11096-82-5Aroclor-1260 34	

PCB ORGANIC	ID S ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA.MO Contract:	262-01	CT00063RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	81171
Matrix: (soil/water) SOIL	Lab Sample ID:	10123-013
Sample wt/vol: 30.1 (g/ml) G	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	01-09-96
Moisture: not dec. 4 dec.	Date Extracted:	01-15-96
Extraction: (SepF/Cont/Sonc) FONC	Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH:		1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016	35	υ
11104-28-2Aroclor-1221	35	D
11141-16-5Aroolor-1232	35	\U
53469-21-9Aroolor-1242	35	
12672-29-6Aroclor-1248	35	
11097-69-1Aroclor-1254		

PCB ORGANI	1D CS ANALYSIS DATA SERET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract:	262-01	CT00064RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	81171
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	10123-014
Sample wt/vol: 30.2 (g/ml) G	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	01-09-96
Moisture: not dec. 4 dec.	Date Extracted:	01-15-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q Q
53469-21-9Aroclor-1242 12672-29-6Aroclor-1248	34 34 34 34 34	р р п п п
11097-69-1Aroclor-1254	3434	

1D PCB ORGANICS ANALYSIS DATA	L Sheet	EPA SAMPLE NO.
Lab Name: OUANTERRA_MO Contract: 262-01		CT00065RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	S1171
Matrix: (soil/water) SOIL Lah S	ample ID:	10123-015
Sample wt/vol: 30.2 (g/ml) G Lab F	ile ID:	
Level: (low/med) LOW Date	Sampled:	01-09-96
* Moisture: not dec Date Ex	tracted: _	01-15-96
Extraction: (SepF/Cont/Sonc) <u>SONC</u> Date	Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH: Dilut	ion Factor:	1.0
CAS NO. Compound (ug/L or ug/L		Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	34 34 34 34	0 0
12672-29-6Aroclor-1248 11097-69-1Aroclor-1254	34 34	U U

1D CS ANALYSIS DATA SHEET	EPA SAMPLE NO.
262-01	CT00066RM
SAS No.: SDG No.:	S1171
Lab Sample ID:	10123-016
Lab File ID:	
Date Sampled:	01-09-96
Date Extracted:	_
Date Analyzed:	01-16-96
Dilution Factor:	1,0
CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	0
34 34 34 34 34 34 34	0 0 0 0 0 0 0
	Z62-01  SAS NO.: SDG NO.:  Lab Sample ID:  Lab File ID:  Date Sampled:  Date Extracted:  Date Analyzed:  Dilution Factor:  CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG  34  34  34  34  34  34  34  34  34  3

1D PCB ORGANICS ANALYSIS I	EPA SAMPLE NO.		
Lab Name: QUANTERRA, MO Contract: 262-01		CT00067RM	
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	\$1171	
Matrix: (soil/water) <u>SOIL</u> L:	ab Sample ID:	10123-017	
Sample wt/vol: 30.1 (g/ml) G	ab File ID:		
Level: (low/med) LOW Da	are Sampled:	01-09-96	
Moisture: not dec. 2 dec. Date	Extracted: _	01-15-96	
Extraction: (SepF/Cont/Sonc) SONC Da	ite Analyzed:	01-16-96	
GPC Cleanup: (Y/N) N pH: Di	ilution Factor:	1.0	
	ation units: ug/kg) <u>ug/kg</u>		
12674-11-2Aroolor-1016 11104-28-2Aroolor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	34 34 34 34 34	0 0	
12672-29-6Aroclor-1248	34		

PCB ORGANICS ANALYSIS DA	TA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-01		CT00068RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	81171
Matrix: (soil/water) SOIL Lab	Sample ID:	i0123-018
Sample wt/vol: 30.2 (g/ml) G Lab	File ID:	
Level: (low/med) LOW Dat	e Sampled:	01-09-96
* Moisture: not dec. 2 dec. Date	Extracted: _	01-15-96
Extraction: (SepF/Cont/Sonc) SONC Date	e Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH: Dil	ution Factor:	1.0
CAS NO. Compound (ug/L or ug	ION UNITS: g/kg) <u>UG/kg</u>	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34 34 34 34 34 34 34	0 0 0 0 0

1D PCB ORGANICS ANALYSIS DATA	EPA SAMPLE NO.
Lab Name: OUANTERRA MO Contract: 262-01	CT00069RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.: \$1171
Matrix: (soil/water) SOIL Lab 8	ample ID: 10123~019
Sample wt/vol: 30,2 (g/ml) G Lab F	'ile ID:
Level: (low/med) LOW Date	Sampled: 01-09-96
% Moisture: not dag. 2 deg. Date Ex	tracted:01~15-96
Extraction: (SepF/Cont/Sonc) SONC Date	Analyzed: 01-16-96
GPC Cleanup: (Y/N) N pH: Dilut	ion Factor: 1.0
CAS NO. Compound (ug/L or ug/	N UNITS: Kg) UG/KG Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	34 U U 34 U U 34 U U 34 U U U U U U U U
12672-29-6Aroclor-1248 11097-69-1Aroclor-1254	34 U U

1D PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262-01

CT00070RM

Lab Name: OUANTERRA, MO Contract:	262-01 CT00070RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:S1171
Matrix: (soil/water) SOUR	Lab Sample ID: 10123-020
Sample wt/vol: 30.2 (g/ml)	Lab File ID:
Level: (low/med) LOW	Date Sampled: 01-09-96
* Moisture: not dec. 2 dec.	Date Extracted: 01-15-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 1.0
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34 U

PCB CRGAWI	1D CS <b>analysis</b> data she <b>et</b>	EPA SAMPLE NO.		
Lab Name: OUANTERRA, MO Contract:	262-01			
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	_51172		
Matrix: (soil/water) <u>SOID</u>	Lab Sample ID:	10123-021		
Sample wt/vol: 30.1 (g/ml) G	Lab File ID:			
Level: (low/med) LOW	Date Sampled: _	01-09-96		
* Moisture: not dec. 3 dec.	Date Extracted:	01-15-96		
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	01-16-96		
GPC Cleanup: (Y/N) N PH:	Dilution Factor:	1.0		
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/kg) <u>UG/kg</u>	~ Ø		
12674-11-2Aroclor-1036	34	U		
11104-28-2Aroclor-2221	34	U		
11141-16-5Aroclor-1232	34			
53469-21-9Aroolor-1242	34			
12672-29-6Aroclor-1248	34	<u>-</u>		
11097-69-1Aroclor-1254	34			

PCB OR	id Gauics <b>ana</b> lybis data s	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contr	aot: <u>262-01</u>	CT00072RM
Lab Code: ITMO Case No.:	SAS No.:	SDG No.: 51172
Matrix: (soil/water) SOIG	Lah Sam	ple ID: 10123-022
Sample wt/vol: 30.0 (g/ml) G		e ID:
Level: (low/med) LOW	Date Sa	mpled: 01-09-96
Moisture: not dec. 2 dec.	Date Extr	acted: 01-15-96
Rxtraction: (SepF/Cont/Sonc)	ONC Date An	alyzed: 01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution	A Factor: 1.0
CAS NO. Compound	CONCENTRATION (ug/L or ug/Kg	
12674-11-2Arcolor-1016 11104-28-2Arcolor-1221 11141-16-5Arcolor-1232 53469-21-9Arcolor-1242 12672-29-6Arcolor-1248		34 U U 34 U U 34 U U U 34 U U U U U U U
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260		34 0

1D
PCE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

,		,
Lab Name: OUANTERRA, MO Contract:	262-01	CT00073RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.: _	51172
Matrix: (soil/water) SOIL	Lab Sample ID:	10123-023
Sample wt/vol: 30.1 (g/ml)	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	01-09-96
* Moisture: not dec. 4 Gec.	Date Extracted:	01-15-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: _	1.9
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	_ Q
12674-11-2Arodlor-1016	35	U
11104-28-2Arodlor-1221		
11141-16-5Aroclor-1232	35	
53469-21-9Aroclor-1242	35 35	
12672-29-6Aroclor-1248	35	
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	35	

U: Concentration of analyte is less than the value given.

ld PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-01	CT00074RM
Lab Code: ITMO Case No.: SAS No.: SDG N	To.: 81172
Matrix: (soil/water) SOIL Leb Sample ID:	10123-024
Sample wt/vol: 30.1 (g/ml) G Lab File ID:	
Level: (low/med) LOW Date Sampled:	01-09-96
* Moisture: not dec. 2 dec. Date Extracted:	01-15-96
Extraction: (SepF/Cont/Bonc) SONO Date Analyzed:	01-16-96
GPC Cleanup: (Y/N) N pH: Dilution Facto	r: <u>1.0</u>
CAS NO. Compound (ug/L or ug/Kg)_UG/KG	· Q
12674-11-2Aroclor-1016     34       11104-28-2Aroclor-1221     34       11141-16-5Aroclor-1232     34       53469-21-9Aroclor-1242     34       12672-29-6	т о ч т
11097-69-1Aroclor-1254 34	

FORM I PBST



Fax Number: (303) 966-8774
Phone Number: (303) 968-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8568

## **PCB RESULTS**

Lab ID	Sample ID	Aroclor 1016	Arocior 1221	Arocior 1232	Aroclor 1242	Arocior 1248	Aroclor 1254	Aroclo	
QCBLK76880	QCBLK76880	33 U	33 U						
9218-001	SS00002RM	34 U	34 U						
9218-002	SS00004RM	34 U	34 U						
9218-003	SS00011RM	34 U	934						
9218-004	SS00016RM	38 U	36 U	141					
9218-005	SS00020RM	33 U	33 U						
9218-005MS	SS00002RM-MS	33 U	33 U	33 U	33 U		79% Rec	33 U	
9218-005MSD	SS00002RM-MSD	33 U	33 U	33 U	33 U		73% Rec	33 U	

U: Not detected at the detection limit stated



100 - 00

To: Wayne Sprolles/Nick Demos Fax Number: (303) 966-8704 Phone Number: (303) 966-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566.

· :	Lab ID	Sample ID 1757	Aroc 10			lor H	Aroc 12	: 1	Aroc 12		Aroc 124		Aroc 12		Aroc 126	1.6
	QCBLK77490	QCBLK77490	33	U	33	U	33	U	33	Ū	33	Ū	33	U	33	Ū
	9268-001	SS00026RM	38	U	38	u	36	υ	36	Ū	36	U	36	U	58	
	9268-002	SS00028RM	36	Ü	36	U	36	U	36	Ü	36	U	36	U	36	U
	9268-003	SS00033RM	39	U	39	U	39	U	39	U	39	U	39	U	1300	

U: Not detected at the detection limit stated

## QUANTERRA (Formerly ITAS - St. Louis) ST. LOUIS, MO

#### FAX TRANSMISSION

TO: N. Demos	
CONPANY: RMRS	
FAX NUMBER: 1-30	3-966-5198
SENDER: Bostono	S. Dely
DATE: 1-23-96	OPERATOR:
Time: 3:00	NUMBER OF PAGES: 12

St. Louis Laboratory

Fax Number: (314) 298-8757

If You Experience Trouble, Call (314) 298-8566

PCB A	eouto	 	· · · · · · · · · · · · · · · · · · ·	_	
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				·····	
					* * * * * * * * * * * * * * * * * * *

Therese A. gr.



Fax Number: (303) 968-8704 Phone Number: (303) 968-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8568

Date: 9/18/95

#### PCB RESULTS

) A 169	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Aroc	ior	Aroc	lor	Aro	clor	Aroc	lor	Aroc	lor	Aro	lor	Aro	clos
Lab ID	Sample ID	10	16	122		12:		124		124		12		120	
QCBLK78083	QCBLK78083	33	Ū	33	Ū	33	U	33	U	33	Ū	33	Ü	33	Ü
9325-001	SS00070RM	36	Ü	36	U	36	Ū	36	Ü	2700		36	Ū	36	Ť
9325-002	SS00079RM	35	U	35	U	35	Ū	35	Ü	300	_	35	Ū	35	Ť
9325-003	SS00090RM	37	U	37	U	37	U	37	U	3100	_	37	Ū	37	Ū
9325-004	SS00094RM	38	U	38	Ù	38	U	38	U	1300	_	38	Ū	38	ŭ
9325-005	SS00095RM	38	U	38	U	38	U	38	U	1800	_	38	ŭ	38	Ť
9325-006	SS00095RM	-35	U	35	Ü	35	U	35	Ü	470		35	Ū	35	<del>Ü</del>

U: Not detected at the detection limit stated

Assert are



Fax Number: (303) 966-8774 Phone Number: (303) 966-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

#### PCB RESULTS

		Aroci	or	Aroc	lor	Aroc	lor	Aroc	lor	Aroc	lor	Arocl	or	Aroc	lor
Lab ID	Sample ID	101	5	123	21	12	32_	124	2	124	8_	1254	1	126	10
QCBLK79526	QCBLK79526	33	U	33	U	33	U.	33	U	33	U	33	U	33	U
9458-001	SS00132RM	37	U	37	U	37	U	37	U	2400		580		37U	
9458-002	SS00137RM	35	U	35	U	35	U	35	U	35	U	14000		35	u
9458-003	SS00146RM	37	П	37	U	37	U	37	U	65		37	U	37	U
9458-004	SS00150RM	35	U	35	u	35	U	35	Ū	300	-	120	•	35	U
9458-005	SS00197RM	37	U	37	U	37	C	37	U	460		37	U	37	וט
9458-006	SS00203RM	37	U	37	U	37	U	37	U	98		37	U	37	U
9458-007	SS00177RM	34	U	34	ΰ	34	U	34	U	34	Ū	1100		34	U
9458-008	SS00185RM	34	U	34	U	34	Ü	34	U	34	U	840		550	
9458-001MS	\$\$00132RM-MS	37	U	37	U	37	บ	37	υ	3100		229%		37	U
9458-001MSD	SS00132RM-MSD	37	U	37	U	37	U	37	U	4300		527%		37	U

U: Not detected at the detection limit stated



Fax Number. (303) 966-8774 Phone Number. (303) 966-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

#### PCB RESULTS

		Aroclor	Aroc	lor	Aro	clor	Aro	clor	Aroc	:lor	Aro	clor	Aro	clor
Lab ID	Sample ID	1016	123	21	12:	32	12	<b>42</b>	124	18	12	54	12	60
QCBLK79323	QCBLK79323	33 U	33	U	33	Ū	33	Ū	33	U	33	U	33	U
9437-001	\$\$00108RM	37 U	37	U	37	U	37	U	160		37	U	37	U
9437-002	SS00171RM	38 U	38	C	38	U	38	U	38	υ	38	U	38	U
9437-003	SS00160RM	36 U	36	U	36	U	36	U	600		36	U	54	
9437-004	SS00162RM	38 U	38	Û	38	ΰ	38	U	5900		38	Ū	38	U
9437-005	SS00165RM	. 39 U	39	U	39	Ü	39	U	44		39	Ų	52	
9437-006	SS00168RM	37 U	37	U	37	U	37	U	2800		37	U	37	U
9437-007	SS00170RM	37 U	37	C	37	U	37	Ų	2300		37	Ū	37	U
9437-001MS	SS00108RM-MS	37 U	37	U	37	U	37	U	320		108%		37	U
9437-001MSD	SS00108RM-MSD	37 U	37	U	37	Ū	37	U	300		109%		37	U

U: Not detected at the detection limit stated

Unito = UG/KG



Fax Number: (303) 966-8774 Phone Number: (303) 966-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

#### PCB RESULTS

Lab ID	Sample ID	Aroc 101		Aroc 122		Aroc 123		Aroc 124		Aroc 124		Aroci		Aroci	
QCBLK79696	QCBLK79696	33	U	33	U	33	Ū	33	Ū	33	U	33	U	33	U
9468-001	SS00206RM	720	U	720	ΰ	720	U	720	U	720	Ū	7000	_	5000	
9468-002	SS00212RM	36	U	36	U	36	U	36	Ū	36	Ū	1600	_	450	
9468-003	SS00213RM	38	Ü	38	Ū	38	U	38	U	38	ับ	1800	_	260	
9468-004	SS00217RM	35	U	35	Ū	35	U	35	U	35	Ū	310	_	220	
9468-001MS	SS00206RM-MS	720	U	720	U	720	Ū	720	Ū	720	Ū	3998%	_	11000	
9468-001MSD	SS00206RM-MSD	720	U	720	U	720	Ü	720	Ü	720	Ü	2387%		6300	

U: Not detected at the detection limit stated

Units UG/KG



Fex Number: (303) 988-5198 6-533 Phone Number: (303) 988-5790

To: Laura Johnson Fax Number: (303) 966-3400

From: John Powell

Fax Number: (314) 298-8757 Phone Number: (314) 298-8568



#### PCB RESULTS

Lab ID QCBLK80123	Sample ID QCBLK80123	Arocios 1016	Arocio 1221	Aro 12	clor 32	Aroc 124	lor 2	Aroc	lor B	Aroc		Aroc	
	1	33 U	33 L	33	11	33	11		7		<del>جر</del>		_
9509-001	SS00234RM	340 U	340 U		÷		-	33		33	U	33	U
9509-002	SS00243RM	77 11		340	U	340	U	340	U	3200		340	U
9509-003	SS00249RM		34 U	34	U	34	U	34	U	320		34	II
	SS002f2RM	34 U	34 U	34	U	34	U	34	U	34	11	34	Ü
		34 U	34 U	34	U	34	Ū	34	<del></del>		~		
3008-005	6S00254RM	33 U	33 U	33	<del>~</del>		兴		븨	580		34	U
			<u> </u>	_33	U	33	U	33	UI	33	uI	33	11

U: Not detected at the detection fimit stated Units: UG/KG



Fax Number: (303) 966-5198 Phone Number: (303) 966-5790

To: Laura Johnson Fax Number: (303) 966-3400

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

#### PCB RESULTS

		Aroclor	Aroc	lor										
Lab ID	Sample ID	1016	123	21	123	32	124	12	124	B	125	4	126	30
QCBLK80123	QCBLK80123	33 U	33	Ū	33	U	33	U	33	Ū	33	U	33	U
9509-001	SS00234RM	340 U	340	U	340	Ū	340	U	340	Ū	3200		340	Ū
9509-002	SS00243RM	34 U	34	U	34	U	34	U	34	Ū	320		34	U
9509-003	SS00249RM	34 U	34	Ū	34	U	34	U	34	Ū	34	Ū	34	Ū
9509-004	SS00252RM	34 U	34	U	34	U	34	U	34	U	580		34	U
9509-005	SS00254RM	33 U	33	U	33	U	33	U	33	Ū	33	υ	33	Ū

U: Not detected at the detection limit stated

Units: UG/KG



Fax Number: (303) 966-5198 6573

Phone Number: (303) 966-5790

To: Laura Johnson

Fax Number: (303) 966-3400

From: John Powell

Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

#### **PCB RESULTS**

	<u> </u>	Aroclor						
Lab ID	Sample ID	1016	1221	1232	1242	1248	1254	1260
QCBLK80444	QCBLK80444	33 U						
9546-001	SS00256RM	35 U	47	35 U				
9546-002	SS00258RM	40 U						
9546-003	SS00265RM	40 U	40 U	40 U	40 U	110	40 U	40 U
9546-004	SS00305RM	34 U	2100	34 U				

U: Not detected at the detection limit stated

Units: UG/KG

	•	
EPA	SAMPT.R	NO

Lab Name: QUANTERRA, MO Contract:	262,01	5500430RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	S1181
Matrix: (soil/water)SOIL	Lab Sample ID:	10377-001
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:	
Level: (low/med) Low	Date Sampled:	02-15-96
% Moisture: not dec. 14 dec.	Date Extracted:	02-21-96
Extraction: (SepF/Cont/Sonc)	Date Analyzed:	02-22-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Eg)_ug/KG	Q
12674-11-2Aroclor-1016	38	<b>ט</b> ַ
11104-28-2Aroclor-1221	38	
11141-16-5Aroclor-1232 53469-21-9Aroglor-1242	38	
12672-29-6Aroclor-1242	38	
11097-69-1Aroglor-1254	38	<del></del> -
11096-82-5Aroclor-1260	120	
	ll	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO. PCB ORGANICS ANALYSIS DATA SHEET SS00430RMHS Lab Name: OUANTERRA, MO Contract: 262.01 Lab Code: 1TMO Case No.: SAS No.: SDG No.: S1181 Lab Sample ID: 10377-001MS Matrix: (soil/water) \_\_SOIL Lab File ID: \_ Sample wt/vol: 30.0 (g/ml) q Date Sampled: 02-15-96 Level: (low/med) LOW 02-21-96 % Moisture: not dec. 14 dec. Date Extracted: Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 02-22-96 Dilution Factor: \_\_\_\_1 GPC Cleanup: (Y/N) N pH: \_\_\_ CONCENTRATION UNITS: Q CAS NO. Compound (ug/L or ug/Kg) UG/KG 12674-11-2-----Aroclar-1016 11104-28-2-----Aroclor-1221 180 BE. 11141-16-5----Aroclor-1232 38 U ם. 53469-21-9-----Aroclor-1242 38 38 38 12672-29-6------Aroclor-1248 ับ 11097-69-1-----Aroclor-1254 11096-82-5-------Aroclor-1260 ַם

u: Concentration of analyte is less than the value given.

FORM I PEST

30<u>0</u>

1d PCB organics analysis data sheet	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262.01	S600430RMHSD
Lab Code: ITMO Case No.: SAS No.: SDC No.:	<b>311</b> 81
Matrix: (Boil/water) SOIL Lab Sample ID:	10377-001MSD
Sample wt/vol: 30.1 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-15-96
Moisture: not dec. 14 dec. Date Extracted:	02-21-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	02-22-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 190 11104-28-2Aroclor-1221 38 11141-16-5Aroclor-1232 38 53469-21-9Aroclor-1242 38	
12672-29-6Aroclor-1248 38 11097-69-1Aroclor-1254 38 11096-82-5Aroclor-1260 260	U U

PCB ORGANIC	1D B ANALYSIS DATA SHEET	EPA SAMPLE NO.
Contract:	262.01	SS00434RM
		61181
<del></del>	Lah Sample ID: _	10377-002
)g	Lab File ID:	
	Date Sampled: _	02-15-96
dec	Date Extracted:	02-21-96
80%	C Date Analyzed:	02-22-96
pH1	Dilution Factor:	1
	CONCENTRATION UNITS: (ug/L or ug/kg) <u>UG/kG</u>	Q
	37 37 37 37 37 37 37 460	
	Contract:	Contract: _262.01

1D PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262.01	\$800437RM
Lab Code: ITHO Case No.: SDG	No.: <u>51181</u>
Matrix: (Soil/water) <u>SOIL</u> Lab Sample ID	: 10377-006
Sample wt/vol: 30.1 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-15-96
* Moisture: not dec. 11 dec. Date Extracted:	02-21-96
Extraction: (SepF/Cont/Sone) 80NC Date Analyzed	: 02-22-96
GPC Cleanup: (Y/N) N pH: Dilution Fac-	tor:1
CAS NO. Compound (ug/L or ug/Kg) UG/K	<u>c</u> Ω
12674-11-2Aroclor-1016 37 11104-28-2Aroclor-1221 37 11141-16-5Aroclor-1232 37	U
53469-21-9	

1D PCB ORGANICS ANALYSIS DATA	SHEET EPA SAMPLE NO.
Lab Name: QUANTERRA.MO Contract: 262.01	PBLK01
Lab Code: ITMO Case No.: 8AS No.:	SDG No.: <u>61182</u>
Matrix: (soil/water) SOIL Lab S	ample ID: BLK92501
Sample wt/vol: 30.0 (g/ml) q Lab F	ile ID:
Level: (low/med) LOW Date:	Sampled:
% Moisture: not dec dec Date Ex	tracted: 02-23-96
Extraction: (SepF/Cont/Sonc) SONC Date 2	Analyzed: 02-28-96
GPC Cleanup: (Y/N) N pH: Dil	ution Factor:1
CAS NO. Compound (ug/L or ug/)	
12674-11-2	33 U

EPA	SAMPLE	ИО
-----	--------	----

Lab Name: <u>QUANTERRA, MO</u> Contract: <u>262</u>	PSPK01
Lab Code: ITMO Case No.: SAS	No.: SDG No.: <u>S1182</u>
Matrix: (soil/water) SOIL	Lab Sample ID: <u>SPK92501</u>
Sample wt/vol: 30.0 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled:
% Moisture: not dec dec	Date Extracted: 02-23-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 02-28-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 1
	NCKNTRATION UNITS: g/L or ug/Kg) UG/KG Q
12674-11-2Aroclor-1016	160
11104-28-2Aroclor-1221 11141-16-5Aroclor-1232	33
53469-21-9Aroclor-1242	33
12672-29-6Aroclor-1248	33 0
11097-69-1Aroclor-1254	33 0
11096-82-5Aroglor-1260	170

U: Concentration of analyte is less than the value given.

#### QUANTERRA, MO Contract: 262.01 Lab Name: Lab Code: ITMO Case No.: SAS No.: \_\_\_\_ SDG No.: <u>S1182</u> Matrix: (soil/water) \_\_SOIL\_\_ Lab Sample ID: 10394-001 Sample wt/vol: 30.2 (g/ml) q Lab File ID: (low/med) LOW Date Sampled: 02-21-96 Level: % Moisture: not dec. 3 dec. Date Extracted: 02-23-96 BONC Extraction: (SepF/Cont/Sono) Date Analyzed: 02-28-96 GPC Cleanup: (Y/N) N pH: \_ Dilution Factor:

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

34

PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SS00463RM

Q

11104-28-2----Aroclor-1221 34 **3**4 11141~16-5-----Aroglor-1232 U 53469-21-9----Aroclor-1242 34 U 12672-29-6-----Aroolor-1248 34 U 11097-69-1----Aroclor-1254 34 U 420 11096-82-5----Aroclor-1260

Concentration of analyte is less than the value given.

Compound

12674-11-2----Aroclor-1016

CAS NO.

•	ld
PCB ORGANICS	
Lab Name: OUANTERRA, MO Contract:	262.01 BS00464RM
Lab Code: ITMO Case No.:	SAS No.: 8DG No.: _81182
Matrix: (soil/water) SOIL	Lab Sample ID: 10394-002
Sample wt/vol: 30.1 (g/ml) g	Lab File ID:

Date Sampled:

SAMPLE NO.

02-21-96

% Moisture:	not dec. 7	dec	Date Extracted:	02-23-96
Extraction:	(SepF/Cont/Sonc)	SONC	Date Analyzed:	02-28-96
GPC Cleanup:	(Y/N) <u>N</u>	рн:	Dilution Factor	:1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
11104-28-2- 11141-16-5- 53469-21-9- 12672-29-6- 11097-69-1-		36 36 36 36 36 36 36 270	0 0 0 0 0

Concentration of analyte is less than the value given. Ü٤

(low/med) LOW

1D PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262.01	SS00473RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	81182
Matrix: (Boil/water) <u>SOIL</u> Lab Sample ID:	10394-003
Sample wt/vol: 30.0 (g/ml) q Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-21-96
Moisturs: not dec. 13 dec. Date Extracted:	02-23-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	02-28-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/kg) UG/kG (ug/L or ug/kg) UG/kG	<b>. Q</b>
12674-11-2Aroclor-1016 38 11104-28-2Aroclor-1221 38 11141-16-5	0 0 0 0 0 0
11096-82-5Aroclor-1260280	

1D EPA SAMPLE NO. PCB ORGANICS ANALYSIS DATA SHEET 8800473RMMS Lab Name: OUANTERRA, MO Contract: 262.01 Lab Code: ITMO Case No.: SAS No.: SDG No.: S1182 Lab Sample ID: 10394-003M8 Matrix: (soil/water) \_\_SOIL\_ Sample wt/vol: 30.1 (g/ml) q Lab File ID: (low/med) LOW Date Sampled: 02-21-96 % Moisture: not dec. 13 dec. Date Extracted: 02-23-96 Extraction: (SepF/Cont/Sonc) \_\_\_SONC Date Analyzed: 02-28-96 Dilution Factor: \_ GPC Cleanup: (Y/N) N рн: \_\_ CONCENTRATION UNITS: Compound (ug/L or ug/Kg) UG/KG CAS NO. Q 140 12674-11-2----Aroclor-1016 11104-28-2----Aroclor-1221 38 ับ 11141-16-5-----Aroclor-1232 38 **ַ** 53469-21-9-----Aroclor-1242 38 ט. 12672-29-6----Aroclor-1248 38 U 11097-69-1-----Aroclor-1254 38 Ů.

U: Concentration of analyte is less than the value given.

11096-82-5----Aroclor-1260

FORM I PEST

39<u>0</u>

PCB ORGANICS ANA	LYSIS DATA SHEET
Lab Name: OUANTERRA, MO Contract: 262	.01 SS00473RMMSD
Lab Code: ITMO Case No.: 6A8	No.: SDG No.: 81182
Matrix: (soil/water) SOIL	Lab Sample ID: <u>10394-003M5D</u>
Sample wt/vol: 30.1 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 02-21-96
Moisture: not dec. 13 dec.	Date Extracted: 02-23-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 02-28-96
GPC Cleanup: (Y/N) N pH:	Dilution Pactor: 1
	NCBNTRATION UNITS: g/L or ug/Kg) uc/Kg Q
12674-11-2Aroclor-1016	140
11104-28-2Aroclor-1221	38 0
11141-16-5Aroclor-1232	38
53469-21-9Aroclor-1242	38U
12672-29-6Aroclor-1248	38
11097-69-1Aroclor-1254	38 U
11096-82-5Aroclor-1260_	350

	PCB ORGANIC	1D 28 Analysis data shket	EPA SAMPLE NO.
Lab Name: _QUANTERRA,MQ	_ Contract:	262.01	SS00477RM
Lab Code: <u>ITMO</u> Case No.: _		SAS No.: SDG No.:	S1182
Matrix: (soil/water) 601	<u>.                                      </u>	Lab Sample ID: _	10394-004
sample wt/vol: 30.2 (g/m	L) <u> </u>	Lab File ID:	
Level: (low/med) LOW	<del></del>	Date Sampled:	02-21-96
% Moisture: not dec. 5		Date Extracted:	02-23-96
Extraction: (SepF/Cont/Sono)	SON	C Date Analyzed: _	02-28-96
GPO Cleanup: (Y/N) N	pH:	Dilution Factor:	1
CAS NO. Compound		CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroslor-101		. 35	ט
11104-28-2		35	U
53469-21-9Aroclor-124		35	
12672-29-6Aroclor-124		35	
11097-69-1Aroclor-125		35	
11096-82-5Aroclor-126		130	———— <u> </u>
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FORM I PEST

600/800D

РСВ (	1D ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: QUANTERRA, MO Cont	tract: <u>262.01</u>	ss00481RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	61182
Matrix: (soil/water)	Lab Sample ID: _	10394-005
Sample wt/vol: 30.1 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled: _	02-21-96
Moisture: not dec. 6 dec.	Date Extracted:	02-23-96
Extraction: (SepF/Cont/Sonc)		02-28-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	<u> </u>
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9	35 35 35 35 35 35 35 35 340	n n n n

# QUANTERRA (Formerly ITAS - St. Louis) ST. LOUIS, MO

FAX TRANSMISSION

TO: RM HINS	CH
COMPANY: RMRS	
FAX NUMBER: 303-	
SENDER: Barbara	5. Dell.
DATE: 7-11-96	OPERATOR: BSP
TIME: 9:40	NUMBER OF PAGES: (INCLUDES COVER)

St. Louis Laboratory

Fax Number: (314) 298-8757

If You Experience Trouble, Call (314) 298-8566

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							<del></del>
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Lab Name:	QUANTERRA, MO	Contract:	262.01	SS00438RM
Lab Code:	ITMO Case No.:		SAS No.: SDG	No.: <u>91181</u>
Matrix: (:	soil/water) <u>SQTL</u>		Lab Sample I	D: 10377-003
Sample wt/	vol: <u>30.2</u> (g/ml	) <u> </u>	Lab Pile ID:	
Level: (	low/med) LOW		Date Sampled	2-15-96
% Moisture	: not dec. 6	dec	Date Extracted	: 02-21-96
Extraction	: (SepF/Cont/Sono)	SON	C Date Analyze	d: <u>02-22-96</u>
GPC Cleanu	р: (Y/N) п	рн:	Dilution Page	ator: 1
CAS NO.	Compound		CONCENTRATION UNITS (ug/L or ug/Kg)_UG/	
	-2Arcolor-101			5 <u>U</u>
	-2Aroclor-122: -5Aroclor-123:			5 U
1	-9Aroclor-124			
	-6Aroclor-1246			5 u
11097-69-	-1Aroclor-125	4	3.	5
11096-82-	-5Aroclor-1260	)	1	80

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262.01	S\$00441RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.: <u>S1181</u>
Matrix: (soil/water) SOIL	Lab Sample ID:
Sample wt/vol: $30.0$ (g/ml) g	Lab File ID:
Level: (low/med) LOW	Date Sampled: 02-15-96
* Moisture: not dec. 18 dec. De	ate Extracted: 02-21-96
Extraction: (SepF/Cont/Sonc)	Date Analyzed: 02-22-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 1
· · · · · · · · · · · · · · · · · · ·	PRATION UNITS: Or ug/Kg) UG/KG Q
12674-11-2Aroclor-1016	40 U
11104-28-2Aroclor-1221	40
11141-16-5-Aroclor-1232	40 0
53469-21-9Aroclor-1242 12672-29-6Aroclor-1248	40 0
11097-69-1Aroclor-1254	
11096-82-5Aroctor-1260	40 0
I	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: QUANTERRA, MO Contract:	S500447RM
Pan Manuer - Additivation - Collegen	AULIVA
Lab Code: ITMO Case No.:	SAS No.: 8DG No.:81181
Matrix: (soil/water)SOIL	Lab Sample ID: 10377-005
Sample wt/vol: 30.0 (g/ml) q	Lab file ID:
Level: (low/med) LOW	Date Sampled: 02-15-96
Moisture: not dec. 8 dec.	Date Extraoted: 02-21-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 02-22-96
GPC Cleanup: (Y/N) N pH:	Dilution Pastor: 1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q
12674-11-2Aroclar-1016	36
11104-28-2Aroclor-1221	36 U
11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	36 U
12672-29-6Aroglor-1248	36
11097-69-1Aroclor-1254	
11096-82-5Aroclor-1260	270
I	

U: Concentration of analyte is less than the value given.

EPA	SAMPI.E	NC

	9500450RM
Lab Name: OUANTERRA, MO Contract: 262.01	
Lab Code: ITMO Case No.: SAS No.: SDG No.:	<u>\$1181</u>
Matrix: (soil/water) SOIL Lab Sample ID:	10377-007
Sample wt/vol: 30.0 (g/ml) q Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-15-96
% Moisture: not dec Date Extracted:	02-21-96
Extraction: (SepF/Cont/Sono) SONC Date Analyzed:	02-22-96
GPC Cleanup: (Y/N) N pH: Dilution Pactor:	1
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 37	σ
11104-28-2Aroclor-1221 37	
11141-16-5Aroclor-1232 37	
53469-21-9Arcelor-1242	
12672-29-6Arctlor-1248 37 11097-69-1Arctlor-1254 37	\ <u>\</u> \
11097-69-1Aroclor-1250	<u>6</u>
	<del></del>

U: Concentration of analyte is less than the value given.

EPA	SAMPLE	NC

Lab Name: <u>QUANTERRA, MO</u> Contract:	262.01	\$500455RM
Lab Code: ITHO Case No.:	SDG No.: SDG No.:	<u>\$1181</u>
Matrix: (soil/water) SOIL	Lab Sample ID:	10377-008
Sample wt/vol: 30.2 (g/ml) g	Lab File ID:	·
Level: (low/med) LOW	Date Sampled: _	02-16-96
% Moisture: not dec. 10 dec.	Date Extracted: _	02-21-96
Extraction: (SepF/Cont/8onc) SONC	Date Analyzed:	02-22-96
GFC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg)_Ug/KG	Q
12674-11-2Aroclor-1016	37	<u> </u>
11104-28-2Aroclor-1221 11141-16-5Aroclor-1232	37	
53469-21-9Aroclor-1242	37	
12672-29-6Aroglor-1248	37	\\ <del></del> \
11097-69-1Aroclor-1254	37	
11096-82-5Aroglar-1260	670	
		iii

U: Concentration of analyte is less than the value given.

BPA SAMPLE NO.

Lab Name: OUANTERRA, HO Contract: 262.01	\$500460RM
Lab Code: ITHO Case No.: SAS No.: SDG No.:	81181
Matrix: (soil/water) SOIL Lab Sample ID:	10377-009
Sample wt/vol: 30.0 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	02-16-96
% Moisture: not dec. 8 dec. Date Extracted:	02-21-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	02-22-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016     36       11104-28-2Aroclor-1221     36       11141-16-5Aroclor-1232     36       53469-21-9	U U

U: Concentration of analyte is less than the value given.



il ru.

To: Wayne Sproiles/Nick Demos Fax Number: (303) 966-8704 Phone Number: (303) 968-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

Date: 9/18/95

					7 A 37										
	11111	Aroc	lor	Aro	lor	Aro	Jor	Aroc	lor	Aroc	lor	Aroc	lor	Aroc	Hor
Lab ID	Sample ID	101	18	12	H	123	32	124	12	124	8	128	14	120	80
QCBLK78083	QCBLK78083	33	Ū	33	U	33	U	33	Ū	33	U	33	U	33	Ū
9325-001	8600070RM	36	U	36	U	38	Ū	36	U	2700		36	U	36	U
9325-002	SS00078RM	35	U	35	U	35	Ū	25	u	300		35	U	35	U
9325-003	S800090RM	37	U	37	V	37	U	37	U	3100		37	U	37	U
9325-004	SS00094RM	38	Ü	38	Ū	38	U	38	U	1300		38	U	38	U
9325-005	SS00095RM	38	U	38	U	38	U	38	U	1800		38	U	38	U
9325-008	S600095RM	35	U	35	U	85	U	35	U	470		35	Ū	35	U

U: Not detected at the detection limit stated



Fax Number: (303) 966-8774
Phone Number: (303) 968-8598

From: John Powell Fax Number: (314) 298-8757 Phone Number: (314) 298-8566

### PCB RESULTS

Lab ID	Sample ID	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Arocior 1260
QCBLK76880	QCBLK76880	33 U	33 U					
9218-001	SS00002RM	34 U	34 U					
9218-002	SS00004RM	34 U	34 U					
9218-003	SS00011RM	34 U	934					
9218-004	SS00016RM	38 U	36 U	36 U	38 U	36 U		
9218-005	SS00020RM	33 U		141				
9218-005MS	SS00002RM-MS	33 U	33 U	33 U	33 U		33 U	33 U
	SS00002RM-MSD	33 U	33 U	33 U	33 U		79% Rec 73% Rec	33 U

U: Not detected at the detection limit stated

### **FAX**



13715 Rider Trail North Earth City, MO 63045-1205

Date	01-22-					
Number of pa	ges including co	over sheet	5		•	
To: Nick	: Demos			From:	n Powell	
	-					<del>_</del>
Рһопе				Phone	(314) 298-8566	
Fax Phone	(303).96	4-5198		Fax Phone	(314) 298-8757	
CC:						_
<b>~~.</b>						
		^ ^ <u> </u>				
ARKS:	Urgent		your review	☐ Reply ASA	NP 📋 Please commer	ıt
ARKS:					NP 📋 Please commen	ıt
ARKS:				□ Reply ASA	NP ☐ Please commen	nt
ARKS:					NP ☐ Please commen	nt
ARKS:					NP ☐ Please commen	it
ARKS:					NP ☐ Please commen	it
ARKS:					VP ☐ Please commen	it
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ARKS:					VP ☐ Please commen	it
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EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract:	262-01 SS00352RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.: _81165
Matrix: (soil/water) SOIL	Lab Sample ID: 9990-001
Sample wt/vol: 30.4 (g/ml) q	Lab Pile ID:
Level: (low/med) LOW	Data Sampled: 12-05-95
% Moisture: not dec. 4 dec.	Date Extracted: 12-18-95
Extraction: (SepF/Cont/Sonc) <u>SONC</u>	Date Analyzed: 12-20-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 10
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q
12674-11-2	340
12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	340 U U 340 U U 3100

U: Concentration of analyte is less than the value given.

EPA.	SAMPLE	'NTO
A-1-	COMPLEX	MI)

Lab Name: QUANTERRA, MO Contract:	262-01	SS00359RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	S1165
Matrix: (soil/water) SOIL	Lab Sample ID:	9990-002
Sample wt/vol: 30.0 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	12-05-95
% Moisture: not dec6 dec	Date Extracted:	12-18-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	12-20-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Arcolor-1016 11104-28-2Arcolor-1221	3535	n n
11141-16-5Aroclor-1232	35	<u> </u>
53469-21-9Aroclor-1242	35	
12672-29-6Aroclor-1248 11097-69-1Aroclor-1254	35 .	
11096-82-5Aroclor-1260	230	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: <u>OUANTERRA, MO</u> Contract:	262-01	2200364RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	S1165
Matrix: (soil/water) SOIL	Lab Sample ID:	9990-003
Sample wt/vol: 30.1 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	12-05-95
% Moisture: not dec8dec	Date Extracted:	12-18-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	12-20-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	2
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	a
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5	72 72 72 72 72 72 72 72 800	7 7 8 9 9

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: <u>QUANTERRA,MO</u> Contract:	262-01	5500367RM
Lab Code: <u>ITMO</u> Case No.:		<u>\$1165</u>
Matrix: (soil/water) SOIL	Lab Sample ID:	9990-004
Sample wt/vol: 30.3 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Şampled:	12-05-95
% Moisture: not dec. 3 dec	Date Extracted: _	12-18-95
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed:	12-20-95
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016	34	ū
11104-28-2Aroclor-1221 11141-16-5Aroclor-1232	34	
53469-21-9Aroclor-1242	34	
12672-29-6Aroclor-1248	34	
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	34 240	

U: Concentration of analyte is less than the value given.

## QUANTERRA (Formerly ITAS - St. Louis) ST. LOUIS, MO



#### FAX TRANSMISSION

TO: DEMOS	/ Reliecca
COMPANY: RMRS	
FAX NUMBER: 1-966-	4046
SENDER: Barbara 5.	Dal
DATE: 5-8-96	OPERATOR: ASD
TIME: 3.40	NUMBER OF PAGES: 20 (INCLUDES COVER)

St. Louis Laboratory

Fax Number: (314) 298-8757

If You Experience Trouble, Call (314) 298-8566

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PARK

EPA SAMPLE NO.

Lab Name: OUANTERRA MO Contract: 262.01	SS00486RM
Lab Code: ITMO Case No.: SAS No.: SDG N	No.: _\$1185
Matrix: (soil/water) <u>SOIL</u> . Lab Sample ID:	: 11002-001
Sample wt/vol: 30.1 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	05-01-96
Moisture: not dec. 14 dea. Date Extracted:	05-06-96
Extraction: (SepF/Cont/Sonc)SONC	: 05-07-96
GPC Cleanup: (Y/N) N pH: Dilution Fact	tor:10
CAS NO. Compound (ug/L or ug/Kg) Ug/K	3Q
12674-11-2Aroclor-1016 380	U
11104-28-2Aroclor-1221 380	
11141-16-5Arodlor-1232 380	
53469-21-9Aroclor-1242 380 12672-29-6Aroclor-1248 380	
11097-69-1Aroclor-1254 380	
11096-82-5Aroclor-1260 8600	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262.01	6500486RMMS
Lab Code: ITMO Case No.: SAS No.: SDG No.:	S1185.
Matrix: (soil/water) SOIL - Lab Sample ID: _	11002-001MS
Sample wt/vol: 30.0 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	05-01-96
Moisture: not dec. 14 dec. Date Extracted:	05-06-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	05-07-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	10
CONCENTRATION UNITS:  CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016	· J
11104-28-2Aroclor-1221390	
11141-16-5Aroclor-1232	
12672-29-6Aroclor-1248 390	——————————————————————————————————————
11097-69-1Aroclor-1254 390	
11096-82-5Aroslor-1260	

U: Concentration of analyte is less than the value given.

EPA	SAMPLE	MO
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				,	
Lab Name: OUANTERRA, MO	Contract:	262.01		SS0048	6RMMSD
Lab Code: ITMO Case No.:		SAS No.: _	SDG No.:	61185	· · · · · ·
Matrix: (soil/water) SOIL		I	ab Sample ID: _	11002-001	MSD
Sample wt/vol: 30.1 (g/ml)	<u> </u>	ı	ab File ID:		
Level: (low/med) LOW	<del></del>	D	ate Sampled:	05-01-96	
* Moisture: not dec. 14	dec	Dat	e Extracted:	05-06-96	
Extraction: (SepF/Cont/Sonc)	SOM	<u>c</u> D	ate Analyzed:	05-07-96	·
GPC Cleamup: (Y/N) N	рн:		Dilution Factor:	1	0
CAS NO. Compound			ATION UNITS: ug/Kg) <u>UG/KG</u>		Q
12674-11-2Aroclor-1016			290 390		
11141-16-5Aroclor-1232			390		U
53469-21-9Aroclor-1242			390		
12672-29-6Aroclor-1248			390		
11097-69-1Aroclor-1254			390		Δ
11096-82-5Aroalor-1260			9100		

U: Concentration of analyte is less than the value given.

BPA SAMPLE NO.

	1	
Lab Name: <u>QUANTERRA, MO</u> Contrac	t: <u>262,01</u>	SS00487RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	S1185
Matrix: (soil/water) SOIL .	Lab Sample ID:	11002-002
Sample wt/vol: <u>30.1 (g/ml) g</u>	Lab File ID:	
Level: (low/med) LOW	Date Sampled:	05-01-96
* Moisture: not dec. 13 dec.	Date Extracted: _	05-06-96
Extraction: (SepF/Cont/Sono)	SONC Date Analyzed:	05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	10
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	_ Q
12674-11-2Aroclor-1016	380	n
11104-28-2Aroclor-1221	380	
11141-16-5Aroclor-1232	380	
53469-21-9Aroclor-1242	380	
12672-29-6Aroclor-1248	380	U
11097-69-1Aroclor-1254	380	U
11096-82-5Aroclor-1260	5300	
1		

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 2	8500488RM
Lab Code: ITMO Case No.:SI	<del></del> ,
Matrix: (soil/water)SOIL	Lab Sample ID: 11002-003
Sample wt/vol: 30.4 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 05-01-96
* Moisture: not dec. 12 dec.	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 50
	CONCENTRATION UNITS: (ug/L or ug/kg) UG/kG Q
12674-11-2Aroclor-1016	1900 U
11104-28-2Aroclor-1221	1900 0
11141-16-5Aroclor-1232	1900 U
53469-21-9Aroglor-1242	1900 U
12672-29-6Aroclor-1248	1900 U
11097-69-1Aroglor-1254	1900 0
11096-82-5Aroclor-1260	20000

U: Concentration of analyte is less than the value given.

RPA SAMPLE NO

Lab Name: OUANTERRA, MO Contract: 262.01	\$\$00489RM
Lab Code: ITMO Case No.: SAS No.	: \$DG No.: _S1185
Matrix: (soil/water) SOIL -	Lab Sample ID: 11002-004
Sample wt/vol: 30.9 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 05-01-96
* Moisture: not dec. 12 dec. I	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-06-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 1
CAS NO. Compound (ug/L	OF ug/Kg) UG/KG Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	37 U U U U U U U U U U U U U U U U U U U

U: Concentration of analyte is less than the value given.

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PCB	ORGANICS	ANALYSIS	DATA	SHRET

EPA SAMPLE NO.

· · · · · · · · · · · · · · · · · · ·	
Lab Name: <u>QUANTERRA, MQ</u> Contract:	262.01 SS00490RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.: _S1185
Matrix: (soil/water)SOIL	Lab Sample ID:
Sample wt/vol: 30.7 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 05-01-96
Moisture: not dec. 14 dec.	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 10
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q
12674-11-2Aroclor-1016	380 0
11104-28-2Aroclor-1221	380 0
11141-16-5Aroclor-1232	380 0
53469-21-9Aroglor-1242	380
12672-29-6Aroclor-1248	380 0
11097-69-1Aroclor-1254	380 0
11096-82-5Aroclor-1260	2400

U: Concentration of analyte is less than the value given.

	EPA	SAMPLE	NO
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Lab Name:	OUANTERRA, MO	Contract	262.01		SS00491RM	
Lab Code:	ITMO Case No.:		SAS No.:	SDG No.:	\$1185	 
Matrix: (	soil/water)80IL	<del></del>	Lab	Sample ID: _	11002-006	
Sample wt/	vol: 30.5 (g/ml)	<u> </u>	Lab	File ID:		
Level: (	low/med) LOW	<u>-</u>	Dat	e Sampled: _	05-01-96	
* Moisture	: not dea. <u>13</u>	dec	Date	Extracted:	05-06-96	
Extraction	: (SepF/Cont/Sond)	SON	C Dat	e Analyzed: _	05-07-96	
GPC Cleanu	p: (Y/N) <u>N</u>	рн:	Di	lution Pactor:	50	
CAS NO.	Compound		CONCENTRAT	ION UNITS: g/kg)_UG/kG	Ω	
12674-11	-2Aroglor-1016			1900	Ū	-
11104-28-	-2Aroclor-1221			1900		-
11141-16-	-5 <b></b> Aroclor-1232			1900	U	_
53469-21-9Aroclor-1242		1900	U	_		
12672-29-6Aroclor-1248			1900	U U		
11097-69-1Arodlor-1254			<del></del>	1900		
11096-82-	-5Aroclor-1260	<del></del>		33000_		
1				1.		- 1

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO

Lab Name: QUANTERRA, MO Contract: 262,01	SS00492RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	S1185
Matrix: (soil/water) SOIL . Lab Sample ID:	11002-007
Sample wt/vol: 30.5 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	05-01-96
Moisture: not dec. 11 dec. Date Extracted:	05-06-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	05-07-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/kg) Ug/kg	Ω
12674-11-2Aroclor-1016     37       11104-28-2Aroclor-1221     37       11141-16-5Aroclor-1232     37       53469-21-9	0 0 0 0 0 0 0

U: Concentration of analyte is less than the value given.

BPA	SA	<b>IPLF</b>	2 1	M

Lab Name:	QUANTERRA, MO	Contract:	262.01	5500493RM
Lab Code:	ITMO Case No.:		SAS No.: SDG No.:	S1185
Matrix: (:	soil/water) <u>SOIL</u>	<del>_</del>	Lab Sample ID:	11002-008
Sample wt/	vol: <u>30.1</u> (g/ml)		Lab File ID:	····
Level: (	low/med) <u>LOW</u>	_	Date Sampled:	05-01-96
t Moisture	: not dec. 15	dec	Date Extracted: _	05-06-96
Extraction	: (SepF/Cont/Sonc)	SONO	Date Analyzed:	05-07-96
GPC Cleanu	p: (Y/N) <u>N</u>	рн:	Dilution Factor:	10
CAS NO.	Compound		CONCENTRATION UNITS: (ug/L or ug/kg) <u>Ug/kg</u>	Q
12674-11	-2Aroclor-1016		390	U
	-2Arodlor-1221		390	U
11141-16-	-5 <b>Ar</b> oglor-1232		390	U
53469-21	-9Aroclor-1242		390	<u>"</u>
,	-6Aroclor-1248		390	
,	11097-69-1Aroclor-1254		390	
11096-82	-5Aroclor-1260		3700	
1			Ì	1

U: Concentration of analyte is less than the value given.

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KPA	NAMULA	N
~	SAMPLE	71/

Lab Name: OUANTERRA, MO Contract:	SS00494RM
	•
Lab Code: ITMO Case No.:	SAS No.: SDG No.: _S1185
Matrix: (soil/water)SOIL	Lab Sample ID:
Sample wt/vol: 30.6 (g/ml) g	Lab File ID:
Level: (low/med) LOW	Date Sampled: 02-16-96
* Moisture: not dec. 12 dec.	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SON	C Date Analyzed: 05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 50
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q
12674-11-2Aroclor-1016	1900 U
11104-28-2Aroclor-1221	1900 U
11141-16-5Aroclor-1232	1900 U
53469-21-9Aroclor-1242 12672-29-6Aroclor-1248	1900
11097-69-1Arodlor-1254	1900
11096-82-5Aroglor-1260	17000

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO

Lab Name: QUANTERRA, NO Contract	: _262.01	SS00495RM
Lab Code: ITMO Case No.:	_ SAS No.: SDG No.: _S	1185
Matrix: (soil/water) SOIL	Lab Sample ID: 11	002-010
Sample wt/vol: 30.6 (g/ml) g	Lab File ID:	
Level: (low/med) LOW	Date Sampled:0	5-01-96
Moisture: not dec7 dec	Date Extracted:	5-06-96
Extraction: (SepP/Cont/Sonc) SC	OMC Date Analyzed: 0	5-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	10
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) Ug/Kg	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	350	
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U: Concentration of analyte is less than the value given.

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RPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262.01	8800496RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	\$1185
Matrix: (soil/water) SOIL Lab Sample ID:	11002-011
Sample wt/vol: 30.6 (g/ml) q Lab File ID:	
Level: (low/med) LOW Date Sampled:	05-01-96
Moisture: not dec. 6 dec. Date Extracted:	05-06-96
Extraction: (SepF/Cont/Sonc)SONC Date Analyzed:	05-07-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	100
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-1016 3500	T T
12674-11-2Aroclor-1016 3500 11104-28-2Aroclor-1221 3500	——————————————————————————————————————
11141-16-5Aroclor-1221 3500	
53469-21-9Aroclor-1242 3500	——————————————————————————————————————
12672-29-6Arodlor-1248 3500	
11097-69-1Aroclor-1254 3500	
11096-82-5Aroglor-1260 86000	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262	.01SS00497RM
Lab Code: ITMO Case No.: SAS	No.: SDG No.: <u>\$1185</u>
Matrix: (soil/water) SOIL	Lab Sample ID:
Sample wt/vol: 30.1 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 05-01-96
% Moisture: not dec. 12 dea.	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 5
	NCENTRATION UNITS: g/L or ug/kg) UG/kg Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	190 188 U 190 U 19

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

Lab Name: QUANTERRA, MO Co	contract: 262.01	SS00498RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:	\$1185
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	11002-013
Sample wt/vol: <u>30.2</u> (g/ml)	qLab File ID:	
Level: (low/med) LOW	Date Sampled:	05-01-96
% Moisture: not dec. 11 de	ec Date Extracted:	05-06-96
Extraction: (SepF/Cont/Song)	SONC Date Analyzed:	05-07-96
GPC Cleanup: (Y/N) N pl	H: Dilution Factor:	1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/kg) <u>UG/kg</u>	Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	37 37 37 37 37 37 37 37 940	а а а п п
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U: Concentration of analyte is less than the value given.

BPA SAMPLE NO.

Lab Name: QUANTERRA, MO Contract:	262.01 SS00499RM	
Lab Code: ITMO Case No.: SI	AS No.: SDG No.: _81185	
Matrix: (soil/water) SOIL	Lab Sample ID:	
Sample wt/vol: _30.4 (g/ml) _ q	Lab File ID:	
Level: (low/med) LOW	Date Sampled: 05-01-96	
* Moisture: not dec. 10 dec.	Date Extracted: 05-06-96	
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-07-96	
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 50	
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG Q	
12674-11-2Aroclor-1016	1800	σ
11104-28-2Aroclor-1221	1800	<u> </u>
11141-16-5Arodlor-1232		σ
53469-21-9Aroclor-1242		0
12672-29-6Aroclor-1248_		0
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	1800 30000	<u> </u>
11070-02-3-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0		

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO

Lab Name: <u>OUANTERRA, MO</u> Contract:	262.01 SS00500RM
Lab Code: ITMO Case No.: S	AS No.: SDG No.: 81185
Matrix: (soil/water) SOIL	Lab Sample ID: <u>11002-015</u>
Sample wt/vol: 30.1 (g/ml) q	Lab File ID:
Level: (low/med) LOW	Date Sampled: 02-16-96
* Moisture: not dec. 7 dec.	Date Extracted: 05-06-96
Extraction: (SepF/Cont/Sonc) SONC	Date Analyzed: 05-07-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) Ug/KG Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5	36 U 37 U 38 U 38 U 39 U
11096-82-5Aroclor-1260_	800

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO. 1D PCB ORGANICS ANALYSIS DATA SHEET PBLK01 Lab Name: QUANTERRA, MO Contract: 262.01 Lab Code: ITMO Case No.: SAS No.: SDG No.: S1185 Lab Sample ID: BLK99429 Matrix: (soil/water) SOIL Lab File ID: Sample wt/vol: 30.0 (g/ml) g (low/med) LOW Date Sampled: Level: Date Extracted: 05-06-96 % Moisture: not dec.\_\_\_\_\_ dec.\_\_\_ Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 05-06-96 Dilution Factor: 1\_ GPC Cleanup: (Y/N) N рн: \_\_\_\_\_ CONCENTRATION UNITS: (ug/L or ug/Kg)\_UG/KG Q CAS NO. Compound 12674-11-2-----Aroclor-1016 11104-28-2------Aroclor-1221 33 33 **ับ** 11141-16-5-----Aroclor-1232 33 53469-21-9----Aroclor-1242 33 'n 12672-29-6-----Aroclor-1248 11097-69-1------Aroclor-1254 11096-82-5-------Aroclor-1260 33 **ื**บ **ט** 33 Ù

U: Concentration of analyte is less than the value given.

KPA SAMPLE NO.

Cab Name:QUANTERRA,MOContract: _262.01	PSPKO1
Lab Code: ITMO Case No.: SAS No.: SDG No.:	\$1185
Matrix: (soil/water) SOIL Lab Sample ID:	SPK99429
Sample wt/vol: 30.0 (g/ml) g Lab File ID:	
Level: (low/med) LOW Date Sampled:	<u> </u>
Moisture: not dec dec Date Extracted:	05-06-96
Extraction: (SepP/Cont/Sonc) SONC	05-06-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/Kg) UG/KG	<b>Q</b>
12674-11-2Aroclor-1016 140	
11104-28-2Aroclor-1221 33	Ű
11141-16-5Aroclor-123233	U
53469-21-9Aroclor-1242 33	
12672-29-6Aroclor-1248	<u>"</u>
11097-69-1Aroclor-1254 33 11096-82-5Aroclor-1260 140	

Ur Concentration of analyte is less than the value given.

# QUANTERRA (Formerly ITAS - St. Louis) ST. LOUIS, MO

#### FAX TRANSMISSION

TO: Rebeca	Hensich
COMPANY: RMR	5
FAX NUMBER: 303	966-4046
SENDER: Bailous	S. Diles
DATE: 8-15-96	OPERATOR: BSD
TIME: 8:45	NUMBER OF PAGES: Uf (INCLUDES COVER)

St. Louis Laboratory

Fax Number: (314) 298-8757

If You Experience Trouble, Call (314) 298-8566

QUANTERRA
(Formerly ITAS - St. Louis)
ST. LOUIS, MO

#### FAX TRANSMISSION

TO: N 3 DEM	05 / Reblica Hirisch
COMPANY: RMR5	
FAX NUMBER: 303-	966-4096
SENDER: Bailous	5. Dilel
DATE: 7-9-96	OPERATOR: 85D
TIME: 3:45	NUMBER OF PAGES: (INCLUDES COVER)

St. Louis Laboratory

Fax Number: (314) 298-8757

If You Experience Trouble, Call (314) 298-8566

X	Relay	to Re 303-966	becoa	Hener	L 0	n 8-	15-96	(Q) 8	8:45
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	1 PCB ORGANICS	d Analysis data sheet	; ,	BPA SAMPLE NO.
Lab Name: OUANTERRA, MO	Contract: _	262-01		\$500\$26RM
Lab Code: ITMO Case No.:	δ.	AS No.:SDG	No.: _i	S1211
Matrix: (soil/water)SOIL		Lab Sample II	):	11444-001
Sample wt/vol: 30.0 (g/ml)	<u> </u>	Lab File ID:		
Level: (low/med) LOW	-	Date Sampled:		06-21-96
% Moisture: not dec. 13	dec	Date Extracted:		07-02 <b>-</b> 96
Extraction: (SepF/Cont/Sonc)	SONG	_ Date Analyzed	iz(	07 <b>-</b> 03-96
GPC Cleanup: (Y/N) N	рН:	Dilution Fa	ctor:	100
CAS NO. Compound		CONCENTRATION UNITS: (ug/L or ug/Kg) UG/K		Q
12674-11-2Aroclor-1016			80	
11104-28-2Arcclor-1221 11141-16-5Arcclor-1232		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	80	
53469-21-9Arogior-1242			80	
12672-29-6Aroclor-1248	<del></del>		80 <u> </u>	
11097-69-1Aroclor-1254			80	
11096-82-5Aroclor-1260	· · · · · · · · · · · · · · · · · · ·	110		<del></del>

FORM I PEST

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Concentration of analyte is less than the value given. Not reported due to AR 1260 interference U:

<sup>⇒:</sup> 

PCE ORGANICS ANALYSIS DA	TA SHEET	EPA SAMPLE NO.
Lab Name: QUANTERRA, MO Contract: 262-01		\$\$00531RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	S1211
Matrix: (Soil/water) SOIL Lab	Sample ID:	11444-002
Sample wt/vol: 30.2 (g/ml) G Lab	File ID:	
Level: (low/med) LOW Date	e Sampled:	06-21-96
W Hoisture: not dec. 14 dec. Date	Extracted: _	07-02-96
Extraction: (SepP/Cont/Sonc) SONC Dat	e Analyzed:	07~03-96
GPC Cleanup: (Y/N) N pH: D	ilution Factor:	100
•	ION UNITS: g/Kg)_UG/KG	_ Q
12674-11-2Aroclor-1016_	380	ס
11104-28-2Aroclor-1221	380	a
11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	380	
12672-29-6Aroclor-1248	380	
11097-69-1Aroclor-1254	380	0
11096-82-5Aroclor-1260	5700	
1		

Concentration of analyte is less than the value given. Not reported due to AR 1260 interference បះ

<sup>#:</sup> 

	PCB ORGANIC	S ANALYSIS DAT	A SHEET	DER SAL	THIE NO.
Lab Name: <u>QUANTERRA,MO</u>	Contract:	262-01		SS005	33RM
Lab Code: ITMO Case No.:		SAS No.:	SDG No.:	\$1212	
Matrix: (soil/water)SOIL		Iab	Sample ID: _	1145	55-001
Sample wt/vol: 30:1 (g/ml)	<u>G</u>	Lab	File ID:		
Level: (low/med) LOW		Date	Sampled: _	_06-24-	-96
Moisture: not dec. 11	dec	Date I	xtracted: _	07-02-9	96
Extraction: (SepF/Cont/Sonc)	SON	C Date	Analyzed:	07-03-9	96
GPC Cleanup: (Y/N) N	pH:	Di	   lution Factor:	:	100
CAS NO. Compound		CONCENTRATI	on units: ykg) <u>ug/kg</u>		Q
12674-11-2Aroclor-1016 11104-28-2Aroclor-122 11141-16-5Aroclor-123 53469-21-9Aroclor-124 12672-29-6Aroclor-124 11097-69-1Aroclor-125 11096-82-5Aroclor-126			3700 3700 3700 3700 3700 3700 70000		
I		i			<u> </u>

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PCB	ORGANICS	ANALYSIS	DATA	SHEET

EPA SAMPLE NO.

Lab Name: QUANTERRA,MO Contract: 262-01	SS00534RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	\$1212
Matrix: (soil/water)SOIL Lab Sample ID:	11455-002
Sample wt/vol: 30.3 (g/ml) G Lab File ID:	
Level: (low/med) LOW Date Sampled:	06-24-96
Moisture: not dec. 10 dec. Date Extracted:	07-02-96
Extraction: (SepF/Cont/Sonc) SONC Date Analyzed:	07-03-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	100
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Q
12674-11-2Aroclor-10163700	
11104-28-2Aroclor-12213700	
11141-16-5Aroclor-1232	
53469-21-9Aroclor-1242 3700	
12672-29-6Aroclor-1248 3700	
11097-69-1Aroclor-1254 3700 11096-82-5Aroclor-1260 46000	

U: Concentration of analyte is less than the value given.

EPA SAMPLE NO.

top olderities immediate	
Lab Name: OUANTERRA, MO Contract: 262-01	\$800535RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.: <u>\$1212</u>
Matrix: (soil/water) SOIL . La	b Sample ID: <u>11455-003</u>
Sample wt/vol: 30.2 (g/ml) G La	b File ID:
Level: (low/med) LOW Da	te Sampled: 06-24-96
% Moisture: not dec. 11 dec. Date	Extracted: 07-02-96
Extraction: (SepF/Cont/Sonc) SONC Da	te Analyzed: 07-03-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor: 100
	TION UNITS: ug/kg) <u>ug/kg</u> Q
12674-11-2Aroclor-1016	3700
11104-28-2Aroclor-1221	3700 0
11141-16-5Aroclor-1232	3700 0
53469-21-9Arodlor-1242	3700 0
12672-29-6Aroclor-1248; 11097-69-1Aroclor-1254	3700
11096-82-5Aroclor-1260	46000

U: Concentration of analyte is less than the value given.

PORM I PRST

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LD DCR ORGANICS ANALYSIS DATA SHRRT EPA SAMPLE NO.

	7 CD CHOILE	~	. Divin omber	
Lab Name: QUANTERRA, MO	Contract:	262-01		SS00537RM
Lab Code: <u>ITMO</u> Case No.:		SAS No.:	SDG No.:	61212
Matrix: (soil/water) SO	IL		Lab Sample ID:	11455-004
Sample wt/vol: 30.3 (g/	ml)G		Lab File ID:	
Level: (low/med) LOW			Date Sampled:	06-24-96
Moisture: not dec. 13	dec	Da	te Extracted:	07-02-96
Extraction: (SepF/Cont/Son	c) <u>son</u>	IC	Date Analyzed:	07-03-96
GPC Cleanup: (Y/N) N	рн:		Dilution Pactor:	100
Cas No. Compound	•		TRATION UNITS: or ug/Kg) <u>UG/KG</u>	_ Q
12674-11-2Aroclor-1	016		3800	U
11104-28-2Aroclor-1	221		3800	ם ו
11141-16-5Arodlor-1	232		3800	U
53469-21-9Aroclor-1			3800-	σ
12672-29-6Aroclor-1	248		3800	
11097-69-1Aroclor-1			3800	U
11096-82-5Aroclor-1	260		49000	
			l	

U: Concentration of analyte is less than the value given.

FORM I PEST

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PCB	ORGANICS	ANALYSIS	DATA	SHEET

EPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract: 262-01	5500538RM
Lab Code: ITMO Case No.: SAS No.: SDG No.:	51212
Matrix: (soil/water) SOIL Lab Sample ID:	11455-005
Sample wt/vol: 30.3 (g/ml) G Lab File ID:	
Level: (low/med) LOW Date Sampled:	06-24-96
Moisture: not dec dec Date Extracted:	07-02-96
Extraction: (SepF/Cont/Sonc)SONC Date Analyzed:	07-03 <b>-</b> 96
GPC Cleanup: (Y/N) N pH: Dilution Factor	100
CAS NO. Compound (ug/L or ug/kg) UG/kg	Q
12674-11-2Aroglor-1016 3700	Ū
11104-28-2Aroclor-1221 3700	Ū.
11141-16-5Aroclor-1232 3700	
53469-21-9Aroclor-1242 3700	
12672-29-6Aroclor-1248 3700	
11097-69-1Aroclor-1254 3700 11096-82-5Aroclor-1260 56000	

FORM I PRST

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Concentration of analyte is less than the value given. . U:

PCB ORGANICS ANALYSIS DATA SH	EPA SAMPLE NO	· -
Lab Name: OUANTERRA, MO Contract: 262-01	9800539RM	
Lab Code: ITMO Case No.: SAS No.:	SDG No.: S1212	
Matrix: (soil/water) <u>SOIL</u> Lab Samp.	le ID:11455-006	
Sample wt/vol: 30.5 (g/ml) G Lab File	ID:	
Level: (low/med) LOW Date Samp	pled: 06-24-96	
Moisture: not dec. 11 dec. Date Extrac	cted: <u>07-02-96</u>	
Extraction: (SepF/Cont/Sonc) SONC Date Ana	lyzed: <u>07-03-96</u>	
GPC Cleanup: (Y/N) N pH: Dilution	on Factor: 100	
CONCENTRATION UP CAS NO. Compound (ug/L or ug/Kg)		
12674-11-2Aroclor-1016	3700	
11104-28-2Aroclor-1221	3700 0	_
11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	3700 U	
12672-29-6Aroclor-1248	3700 U	
11097-69-1Aroclor-1254	3700	
11096-82-5Aroclor-1260	15000	
		-

## Quanterra 13715 Rider Trail North

Earth City, MO 63045

### Fax Cover Sheet

DATE:

July 23, 1996

TIME:

09:24 AM

TO:

Corine Bogert Rocky Flats

PHONE:

(303) 866-9656

FAX:

(303) 966-6783

FROM:

John Powell

PHONE:

(314) 298-8566 (314) 298-8757

FAX:

RE:

**PCBs** 

Number of pages including cover sheet: 17

Message

BPA	SAMPLE	NO

Lab Name:	OUANTERRA, MO	Contract:	262-01		8800545RM
Lab Code:	ITHO Case No.:		SAS No.:	SDG No.	: _81215
Matrix: (	soil/water) SOIL	<del></del>	Lat	Sample ID:	11533-001
Sample wt/	vol: <u>30.3</u> (g/ml)	G	Lat	File ID:	
Lavel: (	low/med) LOW	<del></del>	Dat	o Sampled:	07-03-96
Moisture:	not dec. 12	deo	Date	Extracted:	07-12-96
Extraction	: (SepF/Cont/Sona)	SON	<u>C</u> Dat	e Analyzed:	07-15-96
GPC Cleanu	P: (Y/N) N	p#:		ilution Pacto	r: <u>1</u>
CAS NO.	Compound			rion units:	Q
12674-11-	-2Aroclor-1016			37	а
11104-28-	-2Aroclor-1221			37	<del>u</del>
11141-16-	-5Aroclor-1232			37	. 0
,	-9Aroclor-1242			37	
	-6Aroclor-1248			37	u u
	-1Aroclor-1254			37	σ
11096-82-	-5 Arodlor-1260			37	u
1	· · · · · · · · · · · · · · · · · · ·			1	1 1

U: Concentration of analyte is less than the value given.

	PCB ORGANIC	1D 8 ANALYSIS DATA SHEET	epa sample no.
Lab Name: QUANTERRA,MO	Contract:	262-01	6800546RM
Lab Code: ITMO Case No.:	•		S1215
Matrix: (soil/water)		Lab Sample ID:	11533-002
Sample wt/vol: 30.6 (g/ml	) <u> </u>	Lab File ID:	·
Level: (low/med) LOW		Date Sampled:	07-03-96
* Moisture: not dec. 12	dea	Date Extracted: _	07-12-96
Extraction: (SepF/Cont/Sonc)	SON	Date Analyzed:	07-15-96
GPC Cleanup: (Y/N) N	pH:	Dilution Factor:	1
		CONCENTRATION UNITS:	. •

	(ug/L uz ug/kg)_ug/kg	¥
12674-11-2	37 37 37 37 37 37 37 380	a a a a a a

1D PCB ORGANICS ANALYSIS DA	TA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-01		SS00548RM
Lab Code: ITMO Case No.: SAS No.:	SDG No.:	s1315
Hatrix: (soil/water) SOIL Lab	Sample ID:	11533-003
Sample wt/vol: 30.3 (g/ml) 5 Lab	File ID:	
Level: (low/med) LOW Dat	e Sampled:	07-03-96
* Moisture: not dec. 12 dec. Date	Extracted:	07-12-96
	e Analyzed:	07-15-96
GPC Cleanup: (Y/N) N pH: D	ilution Factor:	1
CAS NO. Compound (ug/L or u	ION UNITS: g/kg)_UG/kg	_ 2
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5	38 38 38	
53469-21-9	3838	<u> </u>
11097-69-1Aroclor-1254 11096-82-5Aroclor-1260	38	
11096-82-9		

PCB ORGANICS ANALYSIS DATA SHEE	EPA SAMPLE NO.
Lab Name: <u>QUANTERRA, HO</u> Contract: 267-01	\$600553RH
Lab Code: ITMO Case No.: SAS No.: S	DG No.: 61215
Matrix: (SOil/water) SOIL Lab Sample	ID: 11533-004
Sample wt/vol: 30.1 (g/ml) G Lab File I	D:
Level: (low/med) Low Date Sampl	ed: 07-03-96
Moisture: not dec. 5 dec. Date Extract	ed: <u>07-12-95</u>
Extraction: (SepF/Cont/Sonc) SONG Date Analy	zed: 07-15-96
GPC Cleanup: (Y/N) N pH: Dilution	Factor: 1
CAS NO. Compound (ug/L or ug/kg) U	
12674-11-2Aroclor-1016 I1104-28-2Aroclor-1221 11141-16-5Aroclor-1232 53469-21-9Aroclor-1242 12672-29-6Aroclor-1248 11097-69-1	35 U

A Section		2.0		24 20	
	120	24.5	A. C. 244		
	AND DEC	n de la c	1	257-	27
470	APR 42:3	100	- PA-0	20.01	1
10	H	7,575-00-	100		
1 . THE		10.00	V		f
7.77	A 14-2 4 2 14	177.4	1 1		

	PCB ORGANIC	1D S ANALYSIS DATA SHBET	EPA SAMPLE NO.
Lab Name: QUANTERRA, MO	_ Contract:	262-01	SS00SE6RM
Lab Code: ITMO Case No.: _		SAS No.: SDG No.:	s1215
Matrix: (soil/water)SOI	<u>u</u> .	Lab Sample ID:	11533-005
Sample wt/vol: 30.3 (g/m	1)G	Lab File ID:	
Level: (low/med) Low		Date Sampled:	07-03-96
Moisture: not dec. 3	dec	Date Extracted:	07-12-96
Extraction: (Sepf/Cont/Sonc	)SON	C Date Analyzed: _	07-15-96
GPC Cleanup: (Y/N) N	рН:	Dilution Factor	:1
CAS NO. Compound		CONCENTRATION UNITS: (ug/L or ug/Kg) Ug/Kg	Q
12674-11-2Aroclor-10 11104-28-2Aroclor-12		34	ÜU
11141-16-5Aroclor-12		34	
53469-21-9Aroclor-12- 12672-29-6Aroclor-12-		34	
11097-69-1Aroclor-12		34	
11096-82-5Aroclor-120		34	<del>0</del>

PCB ORGANICS ANALYSIS DATA SHBB	PPA SAMPLE NO.
Lab Name: OUANTERRA.MO Contract: 262-01	\$\$00563RM
Lab Code: ITMO Case No.: SAS No.: S	DG No.: <u>91215</u>
(atrix: (soil/water) <u>SOIL</u> Lab Sample	ID: 11533-006
Sample wt/vol: 30.1 (g/ml) G Lab File II	D:
Level: (low/med) LOW Date Sample	ed: 07-03-96
Hoisture: not dec. 3 dec. Date Extracte	ed: <u>07-17-96</u>
Extraction: (SepF/Cont/Sonc) SONC Date Analys	zed: <u>07-17-96</u>
OPC Cleanup: (Y/N) N pH: Dilution	Pactor: 1
CAS NO. Compound (ug/L or ug/kg)_U	
12674-11-2Aroclor-1016 11104-28-2Aroclor-1221 11141-16-5	34 U U 34 U U 34 U U 34 U U U 34 U U U 34 U U U 34 U U U U
•	

		LD ANALYSIS DATA SHEET	epa sample no.
Lab Name: OUANTERRA, MO	Contract: _	262-01	\$500569RM
Lab Code: ITMO Case No.:		SAS No.: SDG No.:	\$1215
Matrix: (soil/water) SOIL		Lab Sample ID:	11533-007
Sample wt/vol: _30.0 (g/ml)	<u> </u>	Lab File ID:	
Level: (low/med) LOW	_	Date Sampled:	07-03-96
% Moisture: not dec. 2			
Extraction: (SepF/Cont/Sonc)		-	
GPC Cleanup: (Y/N) N	PB:	· · · · · · · · · · · · · · · · · · ·	
CAS NO. Compound	•	concentration Units: (ug/L or ug/kg) Ug/kg	_ Q
12674-11-2Aroclor-1016		34	tt.
11104-28-2Aroclor-1221		34	\ŏ
11141-16-5Aroglor-1232		34	
53469-21-9Aroclor-1242		34	
12672-29-6		1200	

11097-69-1-----Aroclor-1254 11096-82-5-----Aroclor-1260

Concentration of analyte is less than the value given. Reported from a 1:10 dilution on 07-18-96.

1D PCB ORGANICS ANALYSIS DATA SHBET BPA SAMPLE NO.

Lab Name: OUANTERRA, MO Contract:	262-01 SS00572RM
Lab Code: ITMO Case No.;	SAS No.: SDG No.: _\$1215
Matrix: (soil/water) SOIL	Lab Sample ID:11533-008
Sample wt/vol: 30.4 (g/ml) G	Lab File ID:
Level: (low/med) LOW	Date Sampled: 07-03-96
% Moisture: not dec3dec	Date Extracted: 07-17-96
Extraction: (SepF/Cont/Sonc) SON	C Date Analyzed: 07-18-95
GPC Cleanup: (Y/N) N pH:	Dilution Pactor: 1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg)_UG/KG Q
12674-11-2Aroglor-1016	34 U
11104-28-2Aroclor-1221	34 U
11141-16-5Aroclor-1232 63469-21-9Aroglor-1242	34 0
12672-29-5Aroclor-1248	71
11097-69-1Aroglor-1254	34U
11096-82-5Aroclor-1260	130

U: Concentration of analyte is less than the value given.

PCB ORGANI	ID CS ANALYSIS DATA SHEET	BPA SAMPLE NO.
Lab Name: OUANTERRA, HO Contract:	262-01	SS00578RM
Lab Code: ITMO Case No.:	5A5 No.: 8DG No.:	31215
Hatrix: (Boil/water) SOIL	Lab Sample ID: _	11533-009
Sample wt/vol: 30.4 (g/ml) G	Lab File ID:	
Level: (low/med) LOW	Data Sampled:	07-03-96
* Moisture: not dec5 dec	Date Extracted:	07-17-96
Extraction: (SepP/Cont/Sonc) 60	NO Date Analyzed:	07-18-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	:1
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) <u>UG/KG</u>	Q
12674-11-2	35 35 35 35 36 360 35	- U

1D PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO Contract: 262-01	\$\$00583RM
Lab Code: ITMO Case No.: SAS No.: SDG No.	: \$1215
Matrix: (soil/water) 601L Lab sample ID:	11533-010
Sample wt/vol: 30.3 (g/ml) G Lab Pile ID:	
Level: (low/med) LOW Date Sampled:	07-03-96
% Moisture: not dec. 4 dec. Date Extracted:	07-12-96
Extraction: (Sepf/Cont/Sonc) SONC Date Analyzed:	07-15-96
GPG Cleanup: (Y/N) N pH: Dilution Factor	r:1
CAS NO. Compound (ug/L or ug/Kg) UG/KG	Ω
12674-11-2Aroclor-1016     35       11104-28-2Aroclor-1221     35       11141-16-5Aroclor-1232     35       53469-21-9	2000

1D PCB ORGANICS ANALYSIS DATA SHEET

EPA	SAMPLE	No
-----	--------	----

Lab Name: OUANTERRA.MO Contract:	262-01 8800585RM
Lab Code: ITMO Case No.:	SAS No.: SDG No.:S1215
Matrix: (soil/water) <u>BOIL</u>	Lab Sample ID:11533-011
Sample wt/vol: 30.6 (g/ml) G	Lab File ID:
Level: (low/med) LOW	Date Sampled: 07-03-96
% Moisture: not dec4 dec	Date Extracted: <u>07-15-96</u>
Extraction: (SepP/Cont/Sono)	NO Date Analyzed: 07-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) Ug/Kg Q
12674-11-2Aroclor-1016	34 U
11104-28-2Aroclor-1221	34 0
11141-16-5Aroclor-1232 53469-21-9Aroclor-1242	34 U
12672-29-6	34
11097-69-1Aroolor-1254	34
11096-82-5Aroclor-1260	100
1	

U: Concentration of analyte is less than the value given.

PCB ORGANIC	1D S ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: <u>OUANTERRA.MO</u> Contract:	262-01	5500591RM
ab Code: ITMO Case No.:	SAS No.: SDG No.:	\$1215
datrix: (soil/water)SOIL	Lab Sample ID:	11533-012
Sample wt/vol: 30.1 (g/ml) G	Lab File ID:	
evel: (low/med) LOW	Date Sampled:	07-03-96
Moisture: not dec. 10 dec.	Date Extracted:	07-15-96
extraction: (SepF/Cont/Sonc)	Data Analyzed:	07-16-96
PC Cleanup: (Y/N) N pH:	Dilution Factor:	
CAS NO. Compound	concentration units:	<b>-</b> •
12674-11-2	37	ū
11104-28-2Aroclor-1221 11141-16-5Aroclor-1232	37	\
53469-21-9Aroclor-1242	37	<del></del>
12572-29-6Aroclor-1248	37	
11097-69-1Aroclor-1254	37	
11096-82-5Aroolor-1260	37	U

1 2		2 2 2 2 2
4	1.00	N. Carrie
**	8395.C	2.35
	55 C	
· 1287.243		· 克勒克

NALYSIS DATA SHEET	EPA SAMPLE NO.
52-01	SS00600RM
S No.: SDG No.: _	31215
Lab Sample ID:	11533-013
Lab File ID:	
Date Sampled:	07-08-96
Date Extracted:	07-15-96
Date Analyzed:	07-16-96
Dilution Pactor:	1
CONCENTRATION UNITS:	Ω .
46 46 48 46 46 46 46 46	0 0 0 0 0
	Date Sampled:  Date Sampled:  Date Extracted:  Date Analyzed:  Dilution Factor:  DATE ANALYZED:  DATE ANALYZED

		******

PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: QUANTERRA, NO Contract: 262-01	\$600603RM
Lab Code: ITHO Case No.: SAS No.: SDG No.:	S1215
Matrix: (soil/water) SOIL Lab Sample ID:	11533-014
Sample wt/vol: 30.2 (g/ml) C Lab File ID:	<del></del>
Level: (low/med) LOW Date Sampled:	07-08-96
Moisture: not dec. 9 dec. Date Extracted:	07-15-96
Extraction: (SepP/Cont/Sonc) Date Analyzed:	07-16-96
GPC Cleanup: (Y/N) N pH: Dilution Factor:	1
CAS NO. Compound (ug/L or ug/kg) UG/KG	_ Q
12674-11-2Aroclor-1016 36 11104-28-2Aroclor-1221 36 11141-16-5Aroclor-1232 36 53469-21-9	4 a a a a a a a a a a a a a a a a a a a
11096-82-5Arodor-1260	

ld PCB ORGANICS ANALYSIS	TSSH2 ATAG E	EFA SAMPLE NO.
Lab Name: QUANTERRA.MO Contract: 262-01		вя00609рн
Lab Code: ITMO Case No.: SAS No.:	BDG No.:	81215
Hatrix: (soil/water)SOIL	Lab Sample ID:	11533-015
Level: (low/med) LOW	Date Sampled:	
* Moisture: not dec. 21 dec. Da	ate Extracted: _	07-15-96
Extraction: (SepF/Cont/Sond) SONO	Date Analyzed:	07-16-96
GPC Cleanup: (Y/N) N pH:	Dilution Factor:	
	RATION UNITS: or ug/Kg) UG/KG	_ 0
12674-11-2	42 42 42 42 42 42 42 42	و و و و و و و

1	ld PCB ORGANICS ANALYSIS DATA SHEET	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO	Contract: <u>262-01</u>	8S00612RM
Lab Code: ITMO Case No.:	SAS No.: SDC No.	: 81215
Matrix: (soil/water) <u>SOIL</u>	Lab Sample ID:	11533-016
Sample wt/vol: 30.4 (g/ml)		
Level: (low/med) LOW	Date Sampled:	07-08-96
Noisture: not dec. 4	dec Date Extracted:	07-15-96
Extraction: (SepF/Cont/Sonc)		
GPC Cleanup: (Y/N) N		
CAS NO. Compound	CONCENTRATION UNITS: (ug/L or ug/kg) Ug/kg	
12674-11-2Aroclor-1016	34	ם
11104-28-2 Aroclor-1221	34	\\\
11141-16-5	34	U
53469-21-9Aroglor-1242	34	U
12672-29-6Aroclor-1248	······································	
11097-69-1	34	

	PCB ORGANIC	id Sanalysis :	DATA SHERT	EPA SAMPLE NO.
Lab Name: OUANTERRA, MO	Contract:	262-01		3500616RM
Lab Code: ITMO Case No.:		SAS No.: _	SDG No.:	<b>S1220</b>
Matrix: (soil/water)SOIL		L	ab Sample ID:	11690-001
Sample wt/vol: 30.0 (g/ml)	<u> </u>	L	ab File ID:	
Level: (low/med) LOW	<del></del>	Ď	ate Bampled:	07-30-96
Moisture: not dec. 8	dec	Da	ate Extracted:	08-01-96
Extraction: (SepF/Cont/Sonc)	sono	<u> </u>	ate Analyzed:	08-02-96
GPC Cleanup: (Y/N) N	рн:	D:	Llution Factor:	1
CAS NO. Compound			ation units: ug/kg) <u>ug/kg</u>	_ Q
12674-11-2			36 36 36 36 36 2500 560	0 0 0 0
1				

FORM I PEST

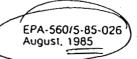
MOVALRKKY

图007000图

# Appendix C

Midwest Research Institute (MRI)
Verification of PCB Spill Cleanup
by
Sampling and Analysis

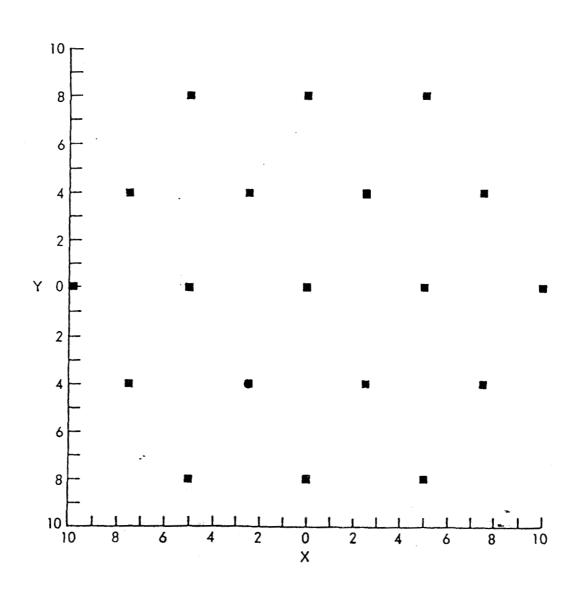
Office of Toxic Substances Washington DC 20460



Toxic Substances



# VERIFICATION OF PCB SPILL CLEANUP BY SAMPLING AND ANALYSIS



# VERIFICATION OF PCB SPILL CLEANUP BY SAMPLING AND ANALYSIS

Ву

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Mitchell D. Erickson
Stephen E. Swanson
Gary L. Kelso
MIDWEST RESEARCH INSTITUTE

and

David C. Cox
Bradley D. Schultz
WASHINGTON CONSULTING GROUP

INTERIM REPORT NO. 2 WORK ASSIGNMENT 37

EPA Contract No. 68-02-3938 MRI Project No. 8501-A(37)

and

EPA Contract No. 68-01-6721 WCG Subcontract to Battelle Columbus Laboratories No. F4138(8149)435

#### Prepared for:

U.S. Environmental Protection Agency
Office of Toxic Substances
Exposure Evaluation Division (TS-798)
401 M Street, S.W.
Washington, DC 20460

tn: Mr. Daniel T. Heggem, Work Assignment Manager Dr. Joseph J. Breen, Project Officer Richard A. Levy, Work Assignment Manager Joseph S. Carra, Project Officer

#### **PREFACE**

This Interim Report was prepared for the Environmental Protection Agency under EPA Contract No. 68-02-3938, Work Assignment 37. The work assignment is being directed by Mitchell D. Erickson. This report was prepared by Dr. Erickson, Bruce A. Boomer, Gary L. Kelso, and Steve E. Swanson of Midwest Research Institute (MRI). The sampling design (Section IV.A) was written by David C. Cox and Bradley D. Schultz of the Washington Consulting Group, 1625 I Street, N.W., Washington, D.C. 20006, under subcontract to Battelle Columbus Laboratories, Subcontract No. F4138(8149)435, EPA Contract No. 68-01-6721 with the Design and Development Branch, Exposure Evaluation Division. The EPA Task Managers, Daniel T. Heggem, Richard A. Levy and John H. Smith, as well as Joseph J. Breen, Joseph S. Carra, and Martin P. Halper, of the Office of Toxic Substances, provided helpful guidance and technical information.

MIDWEST RESEARCH INSTITUTE

Clarence L. Haile Deputy Program Manager

Mohn E. Going Program Manager

Approved:

James L. Spigarelli, Director

James L. Spigarelli

Chemical and Biological Sciences

Department

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#### INTRODUCTION

The U.S. Environmental Protection Agency (EPA) under the authority of the Toxic Substances Control Act (TSCA) Section 6(e) and 40 CFR Section 761.60(d), has determined that polychlorinated biphenyl (PCB) spills must be controlled and cleaned up. The Office of Toxic Substances (OTS) has been requested to provide written guidelines for cleaning up PCB spills, with particular emphasis on the sampling design and sampling and analysis methods to be used for the cleanup of PCB spills.

This work assignment is divided into two phases. The reports of Phase I are presented in Draft Interim Report No. 1, Revision No. 1, "Cleanup of PCB Spills from Capacitors and Transformers," by Gary L. Kelso, Mitchell D. Erickson, Bruce A. Boomer, Stephen E. Swanson, David C. Cox, and Bradley D. Schultz, submitted to EPA on January 9, 1985. Phase I consists of a review and technical evaluation of the available documentation on PCB spill cleanup, contacts with EPA Regional Offices and industry experts, and preparation of preliminary guidelines for the cleanup of PCB spills. The document was aimed at providing guidance in all aspects of spill cleanup for those organizations which do not already have working PCB spill cleanup programs.

Phase II, reported in this document, reviews the available sampling and analysis methodology for assessing the extent of spill cleanup by EPA enforcement officials. This report includes some of the information from the Phase I report, incorporates comments on the Phase I report and the general issue which were received at a working conference on February 26-27, 1985, and addresses the issue from the perspective of developing legally defensible data for enforcement purposes.

This report, intended primarily for EPA enforcement personnel, outlines specific sampling and analysis methods to determine compliance with EPA policy on the cleanup of PCB spills. The sampling and analysis methods can be used to determine the residual levels of PCBs at a spill site following the completion of cleanup activities. Although the methodologies outlined in this document are applicable to PCB spills in general, specific incidents may require special efforts beyond the scope of this report. Future changes in EPA policy may affect some of the information presented in this document.

Following a summary of the report (Section II), Section III presents an overview of PCB spills and cleanup activities. The guidelines on sampling and analysis (Section IV) includes discussion of sampling design, sampling techniques, analysis, and quality assurance.

#### II. SUMMARY

This report presents the results of Phase II of this work assignment. Phase I consisted of a review and technical evaluation of the available documentation on PCB spill cleanup, contacts with EPA Regional Offices, and preparation of preliminary guidelines for the cleanup of PCB spills.

Phase II (this document) reviews the available sampling and analysis methodology for assessing the extent of spill cleanup by EPA enforcement officials. The report incorporates some of the information from the Phase I report and general issues received at a working conference on PCB spills.

The EPA has set reporting requirements for PCB spills and views PCB spills as improper disposal of PCBs. Cleanup activities have not been standardized since PCB spills are generally unique situations evaluated on a case-by-case basis by both the PCB owner (or his contractor) and the responsible EPA Regional Office. Components of the cleanup process may include protecting the health and safety of workers; reporting the spill; quick response/securing the site; determination of materials spilled; cleanup procedures; proper disposal of removed PCB materials; and sampling and analysis. The level of action required is dependent on the amount of spilled liquid, PCB concentration, spill area and dispersion potential, and potential human exposure.

A sampling design is proposed for use by EPA enforcement staff in detecting residual PCB contamination above a designated limit after a spill site has been cleaned. The proposed design involves sampling on a hexagonal grid which is centered on the cleanup area and extends just beyond its boundaries. Guidance is provided for centering the design on the spill site, for staking out the sampling locations, and for taking possible obstacles into account. Additional samples can be collected at the discretion of the sampling crew.

Compositing strategies, in which several samples are pooled and analyzed together, are recommended for each of the three proposed designs. Since an enforcement finding of noncompliance must be legally defensible, the sampling design emphasizes the control of the <u>false positive rate</u>, the probability of concluding that PCBs are present above the allowable limit when, in fact, they are not.

Sampling and analysis techniques are described for PCB-contaminated solids (soil, sediment, etc.), water, oils, surface wipes, and vegetation. A number of analytical methods are referenced; appropriate enforcement methods were selected based on reliability. Since GC/ECD is highly reliable, widely used, and is included in many standard methods, it is a primary recommended method for most samples. Secondary methods may be useful for confirmatory analyses or for special situations when the primary method is not applicable.

Quality assurance (QA) must be applied throughout the entire monitoring program. Quality control (QC) measures, including protocols, certification and performance checks, procedural QC, sample QC, and sample custody as appropriate, should be stipulated in a QA plan.

# III. OVERVIEW OF PCB SPILLS AND CLEANUP ACTIVITIES

# A. Introduction to PCB Spills and Cleanup

The EPA has established requirements for reporting PCB spills based on the amount of material spilled and disposal requirements for the spilled PCBs and materials contaminated by the spill. Under TSCA regulations [40 CFR 761.30(a)(1)(iii) and 40 CFR 761.60d], PCB spills are viewed as improper disposal of PCBs. Although specific PCB cleanup requirements are not established in the TSCA regulations, each regional administrator is given authority by policy to enforce adequate clean-up of PCB spills to protect human health and the environment.

#### Current Trends

Due to regional variations in PCB spill policy and the lack of a national PCB cleanup policy, PCB cleanup activities have not been standardized. Individual companies owning PCB equipment and contract cleanup companies have developed their own procedures and policies for PCB cleanup activities keyed to satisfying the requirements of the appropriate EPA Regional Office. In addition, the EPA Regional Offices typically have provided suggestions for companies unfamiliar with PCB: cleanup.

PCB spills are generally viewed as unique situations to be evaluated on a case-by-case basis by both the PCB owner (or his contractor) and the EPA Regional Office. However, a general framework is often used to approach the problem. Most cleanup activities involve quick response, removal or cleaning of suspected contaminated material, and post-cleanup sampling to document adequate cleanup. Major considerations involved in the cleanup process include minimizing environmental dispersion, minimizing any present or future human exposure to PCBs, protecting the health and safety of the cleanup crew, and properly disposing contaminated materials.

In general, the involvement of EPA Regional Offices is limited to phone conversations often including a follow-up call to receive the analytic results of the post-cleanup sampling. If the EPA representative is not satisfied with the reported data, additional documentation, sampling and analysis, or cleanup (followed by further sampling and analysis) may be requested.

In cases of special concern (e.g., large spills), EPA Regional Offices may work more closely with the PCB owner or contractor in planning the cleanup, sampling and analysis activities, and on-site inspections.

# 2. Limitations of This Overview

The general discussion in this chapter refers to the procedures, policy, and considerations that seem to be widely used at present by PCB owners and spill cleanup contractors in meeting the requirements of the EPA Regional Offices. The activities described do not involve EPA regulations or policy except where indicated, since the EPA has not established requirements on PCB cleanup procedures.

Table 1 categorizes PCB spills into approximate levels of action for PCB spill cleanup based on concern. Potential environmental problems increase with increases in PCB concentrations, amount of spilled liquid, spill area and dispersion potential, and potential human exposure. The three spill types presented in Table 1 are based on very rough estimates. "Severity" in one key item such as human exposure could raise a spill to a Type 3 (i. e., requiring special attention). On the other hand a spill of a large volume of liquid may be considered a Type 2 spill due to a relatively low concentration of PCBs. The three categories are only approximate and are intended to demonstrate the flexibility needed in responding to PCB spills. EPA Regional Offices should provide guidance on spill cleanup activities whenever questions develop.

The situations described in this chapter are limited to recent PCB spills of similar magnitude to the reported spills associated with PCB oil transformers and capacitors (i.e., Type 2 in Table 1). Unusually severe spill incidents (Type 3 in Table 1) involving large volumes of PCBs, a large spill area, a high probability of significant human exposure, and/or severe environmental or transportation scenarios may require special considerations, beyond the scope of this discussion.

All spills from regulated equipment are typically subject to the detail of effort outlined in this chapter. Although cleanup of smaller spills (Type 1 in Table 1) is required if the concentration of PCBs in the spilled material is 50 ppm or greater, the spill and the cleanup activities normally are not reported to EPA.

Future changes in EPA policy may invalidate some of the discussions appearing in this chapter. For example, if EPA adopts any type of formal categorization scheme for PCB spills, some of the assumptions made in this chapter may become inappropriate.

# B. Components of the Cleanup Process

# 1. Health and Safety

Protection of the health and safety of the clean-up crew during the PCB cleanup operation is an important concern. References discussing health and safety considerations relevant to some PCB spill incidents include NIOSH Criteria for A Recommended Standard for Exposure to Polychlorinated Biphenyls (PCBs) (1977c) and Health Hazards and Evaluation Report No. 80-85-745 (NIOSH 1980). The appropriate level of health and safety protection is dependent upon the specifics of the spill.

# 2. Reporting the Spill

If the regulatory limits are exceeded, the spill must be reported to Federal, State, and local authorities as applicable. Under EPA regulations [Fed. Reg. 50:13456-13475], spills over 10 lb must be reported to The National Response Center. The toll free phone number is (800) 424-8802.

Approximate Levels of Action for PCB Spill Cleanup Based on Concern Table 1.

Concern Type 3	> 5	> 1,000 Variable or high	Variable, Askarel	Special concern for high	exposure situations
Categories of increasing concern Type 2	> 1	250 (avg.) ≩ 50	Variable	Various	
Type 1	< 1	< 125 < 500	Mineral oil (or variable)	Various	
* * * * * * * * * * * * * * * * * * *	Approximate gallons of spilled liquid	Area of spill (sq ft) PCB concentration in spilled liquid (ppm)	Types of spilled liquid	Exposure scenario	

Notes:

Type 1 spill is usually not reported.

Type 2 spill is reported and discussed in this chapter.

Type 3 spill is not discussed in this chapter and may require special

EPA assistance.

"Severity" in one key item may raise the spill to a higher risk gategory.

# 3. Quick Response/Securing the Site

Quick response is desirable to mitigate the dispersion of the spilled material and to secure the site. Federal regulations require that cleanup actions commence within 48 hr of discovery of a spill [40 CFR 761.30(a)(1) (iii)]. More rapid response is highly preferable.

A quick response allows removal or cleaning of the PCB-contaminated material before it is dispersed by wind, rain, seepage, and other natural causes or by humans or animals. In securing the site, the cleanup crew determines the spill boundaries, prevents unauthorized access to the spill site, and notifies all parties involved.

The methods used to secure the site will vary on a case-by-case basis, depending on the specific circumstances. The extent of the spill is usually determined by visual inspection with the addition of a buffer area that may include PCBs finely dispersed from splattering. Evaluating the extent of the spill involves considerable judgment, including consideration of the cause of the spill, weather conditions, and specifics of the site.

Field analysis kits may aid the crew in determining the extent of the spill in some instances. The field kits, when used properly, can serve as a screening tool. The need for quick response has limited the usefulness of the more accurate field analytical techniques such as field gas chromatography. Practical problems associated with availability of the equipment and trained staff, set-up time, and cost have limited the use of such techniques at this time.

# 4. Determination of Materials Spilled/Cleanup Plan

After securing the site, the response crew will either (a) immediately proceed with the cleanup operation, or (b) identify the materials spilled and formulate an appropriate cleanup plan. A suitable cleanup plan can be developed by identifying the type of PCB material (i.e., mineral oil, PCB oil, Askarel) and considering such factors as the volume spilled, area of the spill, and site characteristics.

Based on reasoning similar to Table 1, the crew leader can determine the necessary level of effort in accordance with the policy of the PCB owner and the EPA Regional Office. He can determine if additional guidance is needed, plan the sampling and analysis, and make other decisions related to the level of effort and procedures needed.

# 5. Cleanup Procedures

The cleanup procedure may include, but may not necessarily be limited to, the following activities:

- Removal or repair of failed/damaged PCB equipment.
- Physical removal of contaminated vegetation;

- Physical removal of contaminated soils, liquids, etc.,
- Decontamination or physical removal (as appropriate) of contaminated surfaces, and
- Decontamination or removal of all equipment potentially contaminated during the cleanup procedures.
- · Encapsulation may be employed only with EPA approval.

The specific procedures used in a cleanup are selected by the PCB owner or the cleanup contractor. Key considerations include removal of PCBs from the site to achieve the standards required by the EPA region, company, or other applicable control authority; avoidance of unintentional cross contamination or dispersion of PCBs from workers' shoes, contaminated equipment, spilled cleaning solvents, rags, and other sources; and protection of workers' health.

The cleanup crew shall make every possible effort to keep the spilled PCBs out of sewers and waterways. If this has already occurred, the crew needs to contact the local authorities. Water is never used for cleaning equipment or the spill site.

A simple PCB spill cleanup may involve the removal of the leaking equipment, removal of contaminated sod and soil by shovel, cleaning pavement with an absorbant material and solvents, and decontamination or disposal of the workers' equipment (shovels, shoes, gloves, rags, plastic sheets, etc.). More complicated situations may include decontamination of cars, fences, buildings, trees and shrubs, electrical equipment, or water (in pools or bodies of water).

In some cases, adequate decontamination of surfaces (pavements, walls, etc.) may not be possible. An alternate to physical removal of the surface material is encapsulation of the contaminated area under a coating impervious to PCBs. (EPA approval would be required.)

### 6. Proper Disposal of Removed PCB Materials

All PCB-contaminated materials removed from the spill site, must be shipped and disposed in accordance with relevant Federal, State, and local regulations. TSCA Regulations [40 CFR 761.60] outline the requirements for the disposal of PCBs, PCB articles, and PCB containers in an incinerator, high efficiency boiler, chemical waste landfill, or an approved alternative method. Facility requirements for incineration and chemical waste landfills are presented in 40 CFR 761.70 and 40 CFR 761.75, respectively. Applicable Department of Transportation regulations are listed in 49 CFR 172.101.

#### 7. Sampling and Analysis

Although sampling and analysis will be discussed in detail in Chapter IV, this discussion gives an overview of applicable considerations and current practice. Sampling and analysis may not always be needed (especially for the spills described as Type 1 in Table 1), but enforcement authorities or property owners may ask for proof that the spill site has been adequately

decontaminated. This can be accomplished by taking a number of samples representative of the area contaminated by the spill. Samples should represent the full extent of the spill, both horizontal and vertical, as well as the types of materials in the spill area (soil, surfaces, water, etc.).

Sampling design and technique as well as sample handling and preservation should incorporate acceptable procedures for each matrix to be sampled and concern for the adequacy and accuracy for the samples in the final analysis.

Analysis of the samples for PCB content should be performed by trained personnel using acceptable procedures with due consideration of quality assurance and quality control.

Further discussion of sampling and analysis (applicable to EPA enforcement activities) appears in Chapter IV.

#### 8. Remedial Action

If the analysis results indicate the cleanup was not in compliance with designated cleanup levels, additional cleanup is needed. Additional sampling can pinpoint the location of remaining contaminated areas if the original sampling plan was not designed to identify contaminated sub-areas within the spill site. If additional cleanup is needed, the cleanup crew will continue as before, removing more material or cleaning surfaces more thoroughly. Remedial action will be followed by additional sampling and analysis to verify the adequacy of the cleanup.

#### 9. Site Restoration

This is not addressed under TSCA and is a matter to be settled between the company responsible for the PCB spill and the property owner.

#### 10. Records

Although there are no TSCA requirements for records of PCB cleanup activities except for documentation of PCBs stored or transported for disposal [40 CFR 761.80(a)], the PCB owner should keep records of the spill cleanup in case of future questions or concern. Relevant information may include dates, a description of the activities, records of shipment and disposal of PCB-contaminated materials, and a report of collected samples and results of analysis.

#### 11. Miscellaneous Considerations

- a. Expeditious and effective action are desired throughout the cleanup process to minimize the concern of the public, especially residents near the site or individuals with a special interest in the site. Likewise, speed and effectiveness in the cleanup may prevent any future concern or action related to the PCB spill.
- b. Education and training of the spill response crews and responsible staff members is a constant concern. The employees need sufficient training to make proper judgements and to know when additional assistance or guidance is needed.

#### IV. GUIDELINES ON SAMPLING AND ANALYSIS

Reliable analytical measurements of environmental samples are an essential ingredient of sound decisions for safeguarding public health and improving the quality of the environment. Effective enforcement monitoring should follow the general operational model for conducting analytical measurements of environmental samples, including: planning, quality assurance/ quality control, verification and validation, precision and accuracy, sampling, measurements, documentation, and reporting. Although many options are available when analyzing environmental samples, differing degrees of reliability, dictated by the objectives, time, and resources available, influence the protocol chosen for enforcement monitoring. The following section outlines the factors critically influencing the outcome and reliability of enforcement monitoring of PCB spill cleanup.

# A. Sampling Design

This section presents a sampling scheme, for use by EPA enforcement staff, for detecting residual PCB contamination above a limit designated by EPA-OPTS after the site has been cleaned up. Two types of error traceable to sampling and analysis are possible. The first is false positive, i.e., concluding that PCBs are present at levels above the allowable limit when, in fact, they are not. The false positive rate for the present situation should be low, because an enforcement finding of noncompliance must be legally defensible; that is, a violator must not be able to claim that the sampling results could easily have been obtained by chance alone. Moreover, all sampling designs used must be documented or referenced.

The second type of error possible is a false negative, i.e., failure to detect the presence of PCB levels above the allowable limit. The false negative rate will depend on the size of the contaminated area and on the level of contamination. For large areas contaminated at levels well above the allowable limit, the false negative rate must, of course, be low to ensure that the site is brought into compliance. The false negative rate can increase as the area or level of contamination decrease.

# Proposed Sampling Design

In practice, the contaminated area from a spill will be irregular in shape. In order to standardize sample design and layout in the field, and to protect against underestimation of the spill area by the cleanup crew, sampling within a circular area surrounding the contaminated area is proposed. Guidance on choosing the center and radius of the circle, as well as the number of sample points to be used is provided in Section 2 below.

The detection problem was modeled as follows: try to detect a circular area of uniform residual contamination whose center is randomly placed within the sampling circle. Figure 1 illustrates the model. The figure depicts a sampling circle of 10 ft centered on a utility pole (site of the spill). After cleanup, a residually contaminated circle remains. However, in choosing locations at which to sample, the sampler has no knowledge of either the location of the circle or the level of contamination. This ्र स्थापन विश्वविद्या । स्थापन के प्रत्या के प्रदेश के प्रत्या । विश्वविद्या के प्रत्या के प्रत्या के प्रत्या क प्रत्या के प्रिक्त के प्रत्या के क्षेत्रकार के प्रदेश के प्रत्या । विश्वविद्या के प्रत्या के प्रत्या के प्रत्य के कि क्षेत्रकार के स्थापन के कि प्रत्या के प्रदेश के प्रत्या । विश्वविद्या के प्रत्या के प्रत्या के प्रत्या क

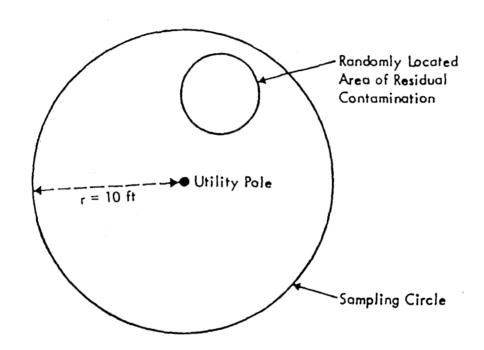


Figure 1. Randomly located area of residual contamination within the sampling circle.

lack of knowledge was modeled by treating the sampling locations as fixed and the center of the contaminated circle as a <u>randomly</u> located point in the circle of radius 10 ft. The implicit assumption that residual contamination is equally likely to be present anywhere within the sampling area is reasonable, at least as a first approximation (Lingle 1985). This is because more effort is likely to have been expended in cleaning up the areas which were obviously highly contaminated.

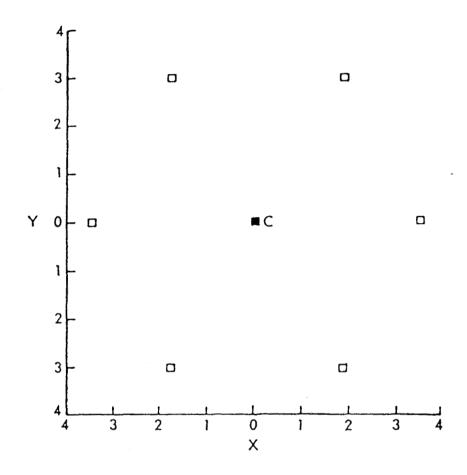
Two general types of design are possible for this detection problem: grid designs and random designs. Random designs have two disadvantages compared to grid designs for this application. First, random designs are more difficult to implement in the field, since the sampling crew must be trained to generate random locations onsite, and since the resulting pattern is irregular. Second, grid designs are more efficient for this type of problem than random designs. A grid design is certain to detect a sufficiently large contaminated area while some random designs are not. For example, the suggested design with a sample size of 19 has a 100% chance to detect a contaminated area of radius 2.8 ft within a sampling circle of radius 10 ft. By contrast, a design based on a simple random sample of 19 points has only a 79% chance of detecting such an area.

Therefore, a grid design is proposed. A hexagonal grid based on equilateral triangles has two advantages for this problem. First, such a grid minimizes the circular area certain to be detected (among all grids with the same number of points covering the same area). Second, some previous experience (Mason 1982; Matern 1960) suggests that the hexagonal grid performs well for certain soil sampling problems. The hexagonal grid may, at first sight, appear to be complicated to lay out in the field. Guidance is provided in Section 2 below and shows that the hexagonal grid is quite practical in the field and is not significantly more difficult to deploy than other types of grid.

The smallest hexagonal grid has 7 points, the next 19 points, the third 37 points as shown in Figures 2 through 4. In general, the grid has  $3n^2 + 3n + 1$  points. To completely specify a hexagonal grid, the distance between adjacent points, s, must be determined. The distance s was chosen to minimize, as far as possible, the size of the residual contaminated circle which is certain to be sampled. Values of s so chosen, together with number of sampling points and radius of smallest circle certain to be sampled are shown in Table 2. For example, the grid spacing for a circle of radius 20 ft for the 7-point design is s = (0.87)(20) = 17.4 ft. For a given size circle, the more points on the grid, the smaller the residual contamination area which can be detected with a given probability.

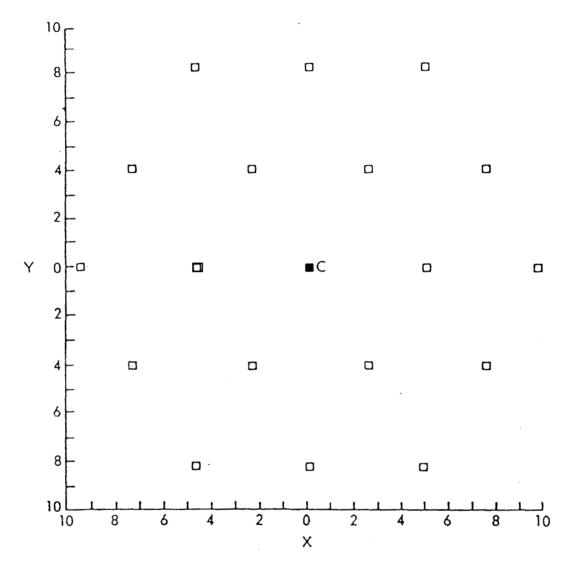
Table 2. Parameters of Mexagonal Sampling Designs for a Sampling Circle of Radius r Feet

No. of points	Distance between adjacent points, s (ft)	Radius of smallest circle certain to be sampled
7	0.87r	0.5r
19	0.48r	0.28r
37	0.3r	0.19r



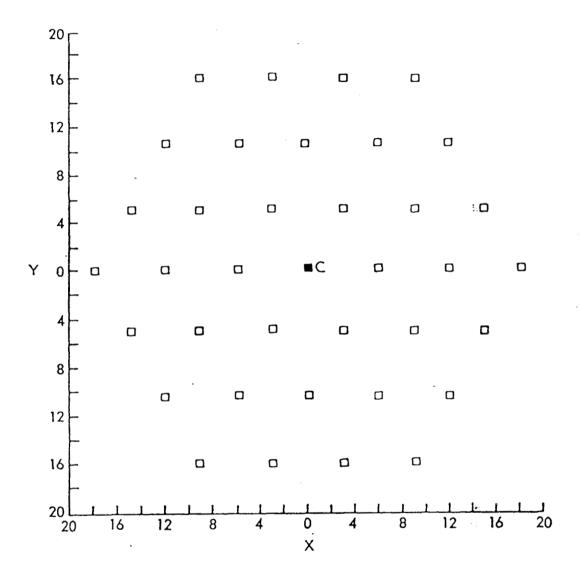
The outer boundary of the contaminated area is assumed to be 4 feet from the center (C) of the spill site.

Figure 2. Location of sampling points in a 7-point grid.



The outer boundary of the contaminated area is assumed to be 10 feet from the center (C) of the spill site.

Figure 3. Location of sampling points in a 19-point grid.



The outer boundary of the contaminated area is assumed to be 20 feet from the center (C) of the spill site.

Figure 4. Location of sampling points in a 37-point grid.

The first three hexagonal designs are shown in Figures 2 to 4, for a sampling circle radius of r=10 ft. The choice of sample size depends on the cost of analyzing each sample and the reliability of detection desired for various residually contaminated areas. Subsection 2 below provides some suggested sample sizes for different spill areas, based on the distribution of spill areas provided by the Utility Solid Waste Activities Group (USWAG 1984; Lingle 1985).

# 2. Sample Size and Design Layout in the Field

# a. Sample Size

The distribution of cleanup areas for PCB capacitor spill sites, based on data collected by USWAG (1984; Lingle 1985) is shown in Table 3. The smallest spill recorded in the USWAG database is 5 ft $^2$ , the largest 1,700 ft $^2$ . The median cleanup area is 100 ft, the mean 249 ft $^2$ ; the wide discrepancy between the mean and the median reflects the presence of a small percentage of relatively large spills in the database.

Recommended sample sizes are given in Table 4. Several considerations were involved in arriving at these recommendations. First, the maximum number of samples recommended for the largest spills is 37, in recognition of practical constraints on the number of samples that can be taken. Even so, it is important to note that not all samples collected will need to be analyzed. The calculations in Section 5 below show that, even for the 37 sample case, no more than 8 analyses will usually be required to reach a decision. Since the cost of chemical analyses is a substantial component of sampling and analysis costs, even the 37-sample case should not, therefore, be prohibitively expensive. Second, the typical spill will require 19 samples. Small spills, with sampling radius no greater than 4 ft, will have 7 samples, while the largest spills, with sampling radius 11.3 ft and up, will require 37 samples. It should be noted that only capacitor spills are represented in Table 3. Transformer spills, however, would be expected to be generally smaller than capacitor spills because energetic releases are less likely from transformers. Thus, one would expect the smaller sample sizes to be relatively more likely for transformer spills than capacitor spills.

Table 3. Distribution of PCB Capacitor Spill Cleanup Areas Based on 80 Cases

leanup area (ft <sup>2</sup> )	Percent of cases
≨ 50	32.5
51-100	18.8
101-200	15.0
201-300	12.5
301-400	3.8
401-700	7.5
701-1,300	8.8
≥ 1,300	1.3

Source: Lingle 1985.

Table 4. Recommended Sample Sizes

Radius of sampling circle (ft)	Percent of PCB capacitor spills	Sample size
≨ 4	32.5	7
4-11.3	50.0	19
> 11.3	17.5	37
	≤ 4 4-11.3	

The final consideration in recommending sample sizes was to achieve roughly comparable detection capability for different size spills. The radius of the smallest contaminated circle certain to be sampled at least once by the sampling scheme is used for comparative purposes (see Table 2). Table 5 presents some calculations of this quantity. The absolute detection capability of the sampling scheme is seen to be relatively constant for different spill sizes. This means that a given area of residual contamination is about as likely to be detected in any sized spill.

Table 5. Detection Capability of the Recommended Sampling Schemes

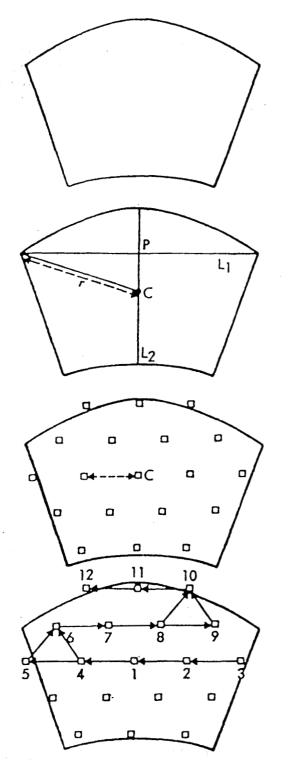
Sampling area (ft <sup>2</sup> )	Radius (ft)	Sample size	Radius of smallest circle to be sampled (ft)
50	4.0	7	2.0
150	6.9	19	1.9
400	11.3	19	3.2
875	16.7	37	3.2

# b. Design Layout in the Field

Figure 5 presents a typical illustration of design layout in the field. The first step is to determine the boundaries of the original cleanup area (from records of the cleanup). Next, find the center and radius of the sampling circle which is to be drawn surrounding the cleanup area. The following approach is recommended:

- (a) Draw the longest dimension,  $L_1$ , of the spill area.
- (b) Determine the midpoint, P, of L<sub>1</sub>.
- (c) Draw a second dimension,  $L_2$ , through P perpendicular to  $L_1$ .
- (d) The midpoint, C, of  $L_2$  is the required center.
- (e) The distance from C to the extremes of  $L_1$  is the required radius, r.

Figure 5 shows an example of the procedure; Figure 6 demonstrates how the center is determined for several spill shapes. Even if the center determined is slightly off, the sampling design will not be adversely affected.



(a) Original cleanup area

(b) Locating the center of the sampling circle

(c) Centering the hexagonal grid

(d) Staking out the grid points

Once the sampling radius, r, has been found, the sample size can be selected based on Table 4.

Example: Suppose r = 5 ft. From Table 4, a sample size of 19 should be used.

Having selected the sample size, the grid spacing can be calculated from Table 2.

Example (continued): For a 19-point design with radius r = 5, the grid spacing is s = 0.48r = (0.48)(5) = 2.4 ft.

The procedure for laying out a 19 point design is as follows. The first sampling location is the center C of the sampling circle, as shown in Figure 5. Next, draw a diameter through C and stake out locations 2 through 5 on it as shown; adjacent locations are a distance s apart. The orientation of the diameter (for example east-west) used is not important; it may be chosen at random or for the convenience of the samplers. The next 4 locations, Nos. 6-9, are laid out parallel to the first row, again a distance s apart. The only difficulty is in locating the starting point, No. 6, for this row. To accomplish this the sampler needs two pieces of rope (or surveyor's chain, or equivalent measuring device) of length s. Attach one piece of rope to the stake at each location 4 and 5. Draw the ropes taut horizontally until they touch at location 6. Once the second row is laid out, the third and final row of 3 locations in the top half of the design is found similarly, starting with number 10. In the same way, the bottom half of the design is staked out. The 7-point or 37-point designs are laid out in an analogous fashion.

Once the sampling locations are staked out the actual samples can be collected. In the example in Figure 5, three of the sampling locations fall outside the original cleanup area. Samples should be taken at these points, to detect contamination beyond the original cleanup boundaries. This verifies that the original spill boundaries were accurately assessed.

In practice, various obstacles may be encountered in laying out the sampling grid. Many "obstacles" can be handled by taking a different type of sample, e.g., if a fire hydrant is located at a point in a sampling grid otherwise consisting of soil samples, then a wipe sample should be taken at the hydrant, rather than taking a sample of nearby soil. The obstacle most likely to be encountered is a vertical surface such as a wall. To determine the sampling location on such a surface, draw taut the ropes (chains) of length s attached to two nearby stakes and find the point on the vertical surface where their common ends touch. See Figure 7 for an illustration of the procedure. If more samples from the vertical surface are called for, the same principle may be applied, always using the last two points located to find the next one.

#### 3. Judgemental Sampling

The inspector or sampling crew may use best judgement to collect samples wherever residual PCB contamination is suspected. These samples are

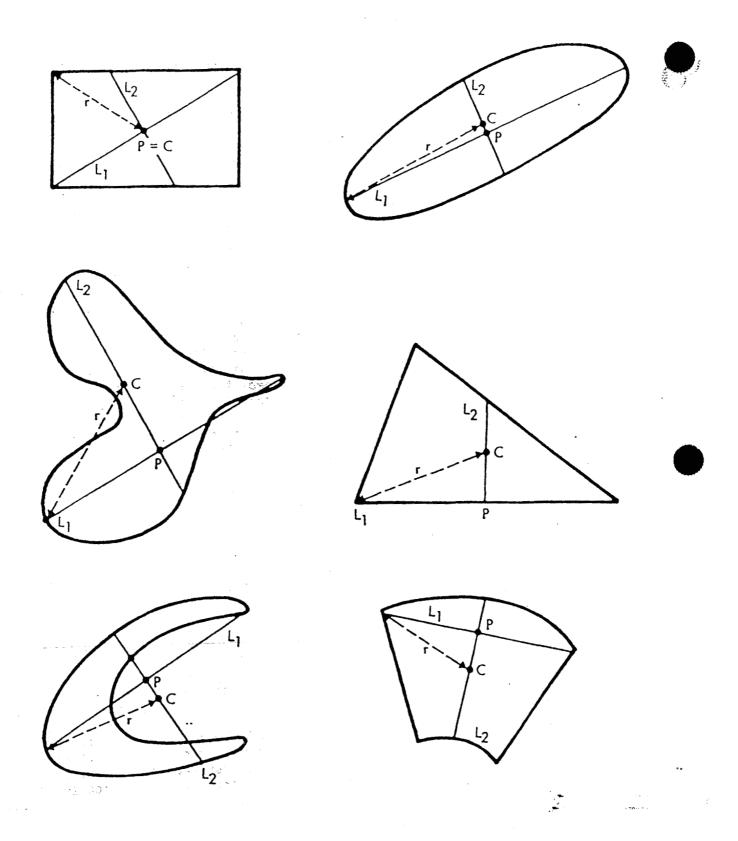


Figure 6. Locating the center and sampling circle radius of an irregularly shaped spill area.

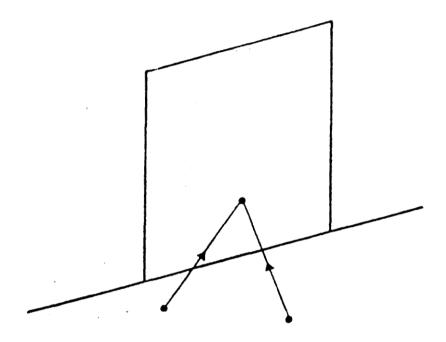


Figure 7. Location of a sampling point on a vertical surface.

in addition to those collected from the sampling grid. Examples of extra sampling points include suspicious stains outside the designated spill area, cracks or crevices, and any other area where the inspector suspects inadequate cleanup.



## 4. Compositing Strategy for Analysis of Samples

Once the samples have been collected at a site, the goal of the analysis effort is to determine whether at least one sample has a PCB concentration above the allowable limit. This sampling plan assumes the entire spill area will be recleaned if a single sample contaminated above the limit is found. Thus, it is not important to determine precisely which samples are contaminated or even exactly how many. This means that the cost of analysis can be substantially reduced by employing compositing strategies, in which groups of samples are thoroughly mixed and evaluated in a single analysis. If the PCB level in the composite is sufficiently high, one can conclude that a contaminated sample is present; if the level is low enough, all individual samples are clean. For intermediate levels, the samples from which the composite was constructed must be analyzed individually to make a determination. Thus, the number of analyses needed is greatly reduced in the presence of very high levels of contamination in a few samples or in the presence of very low levels in most samples.

For purposes of this discussion, assume that the maximum allowable PCB concentration in a single soil sample is 10 ppm. The calculations can easily be adapted for a different level or for different types of samples. Based on review of the available precision and accuracy data (Erickson 1985), method performance of 80% accuracy and 30% relative standard deviation should be attainable for soil concentrations above 1 ppm.

To protect against false positive findings due to analytical error, the measured PCB level in a single sample must exceed some cutoff greater than 10 ppm for a finding of contamination. Assume that a 0.5% false positive rate for a single sample is desired. As will be shown later, this single sample false positive rate controls the overall false positive rate of the sampling schemes to acceptable levels. Then, using standard statistical techniques, the cutoff level for a single sample is

$$(0.8)(10) + (2.576)(0.3)(0.8)(10) = 14.2 \text{ ppm},$$

where 0.8(80%) represents the accuracy of the analytical method, 10 ppm is the allowable limit for a single sample, 2.576 is a coefficient from the standard normal distribution, and 0.3(30%) is the relative standard deviation of the analytical method. Thus, if the measurec level in a single sample is 14.2 ppm or greater, one can be 99.5% sure that the true level is 10 ppm or greater.

Now suppose that a composite of, say, 7 samples is analyzed. The true PCB level in the composite (assuming perfect mixing) is simply the average of the 7 levels of the individual samples. Let X ppm be the measured PCB level in the composite. If  $X \le (14.2/7) = 2.0$ , then all 7 individual samples

are rated clean. If X > 14.2, then at least one individual sample must be above the 10 ppm limit. If  $2.0 < X \le 14.2$ , no conclusion is possible based on analysis of the composite and the 7 samples must be analyzed individually to reach a decision. These results may be generalized to a composite of any arbitrary number of samples, subject to the limitations noted below.

The applicability of compositing is potentially limited by the size of the individual specimens and by the performance of the analytical method at low PCB levels. First, the individual specimens must be large enough so that the composite can be formed while leaving enough material for individual analyses if needed. For verification of PCB spill cleanup, adequacy of specimen sizes should not be a problem. The second limiting factor is the analytical method. Down to about 1 ppm, the performance of the stipulated analytical methods should not degrade markedly. Therefore, since the assumed permissible level is 10 ppm, no more than about 10 specimens should be composited at a time.

In compositing specimens, the location of the sampling points to be grouped should be taken into account. If a substantial residual area of contamination is present, then contaminated samples will be found close together. Thus, contiguous specimens should be composited, if feasible, in order to maximize the potential reduction in the number of analyses produced by the compositing strategy. Rather than describe a (very complicated) algorithm for choosing specimens to composite, we have graphically indicated some possible compositing strategies in Figures 8 Through 11. Based on the error probability calculations presented in Section 4 below, we recommend the compositing strategies indicated in Table 6. The recommended strategy for the 7-point design requires no explanation. The strategies for the 19- and 37-point cases are shown in Figures 9 and 11, respectively. The strategies shown in Figures 8 and 10 are used in Section 5 for comparison purposes. For details on the reduction in number of analyses expected to result (as compared to individual analyses), see the next Section, 5.

# 5. <u>Calculations of Average Number of Analyses, and Error Probabilities</u>

Estimates of expected number of analyses and probabilities of false positives (incorrectly deciding the site is contaminated above the limit), and false negatives (failure to detect residual contamination) were obtained for various scenarios. The calculations were performed by Monte Carlo simulation using 5,000 trials for each combination of sample size, compositing strategy, level, and extent of residual contamination. The computations were based on the following assumptions:

a. Only soil samples are involved. In practice other types of samples will often be obtained and analyzed. Although the results of this section are not directly applicable to such cases, they do indicate in general terms the type of accuracy obtainable and the potential cost savings from compositing.

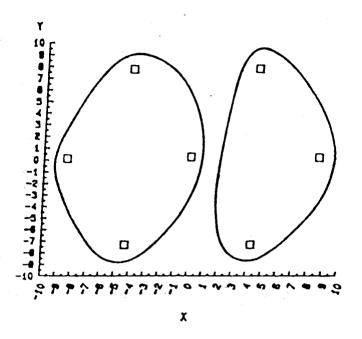


Figure 8

## A 2 GROUP COMPOSITING PLAN FOR 19 SAMPLE POINTS

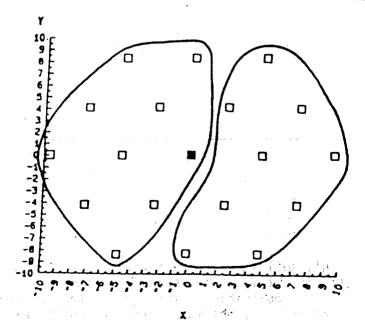


Figure 9

## A 6 GROUP COMPOSITING PLAN FOR 19 SAMPLE POINTS

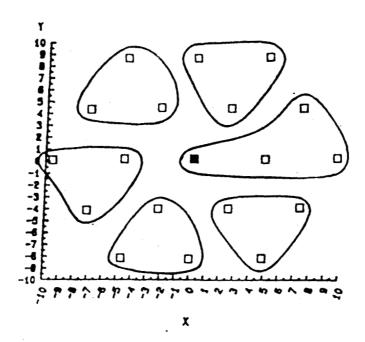


Figure 10. Location of sample points in a 19 sample point plan, with detail of a 2 group compositing design.

## A 4 GROUP COMPOSITING PLAN FOR 37 SAMPLE POINTS

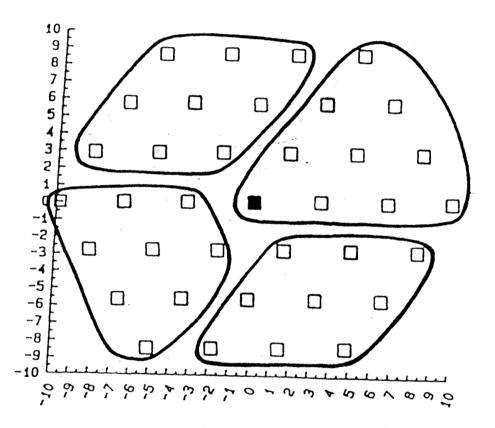


Figure 11. Location of sample points in 37 sample point plan, with detail of a 4 group compositing design.

Table 6. Recommended Compositing Strategies

Compositing strategy
One group of 7
One group of 10, one of 9
Three groups of 9, one of 10

- b. If the true PCB level in a sample is C, then the measured value is a normally distributed random variable with mean 0.8C and standard deviation (0.3)(0.8C) = 0.24C. Thus, it is assumed that the analytical method is 80% accurate, with 30% relative standard deviation.
- c. The maximum allowable level in a single sample is 10 ppm. However, the <u>measured</u> level for a single sample must exceed 14.2 ppm for a finding of noncompliance. As previously discussed, this corresponds to a single-sample false positive rate of 0.5%.
- d. The residual contamination present is modeled as a randomly placed circle of variable radius and contamination level. The PCB level is assumed to be uniform within the randomly-placed circle and zero outside it.
- e. Analysis of samples is terminated as soon as a positive result is obtained on a single analysis. If a composite does not give a definitive result (positive or negative), the individual specimens from which the composite was formed are analyzed in sequence before any other composite.
- f. The compositing strategies used are shown in Figures 8 and 11.

The results of the computations are shown in Tables 7 through 20. Tables 7 through 12 show the performance of the compositing strategies recommended in Section 3. For each strategy, there is a pair of tables. The first table shows the probability of reporting a violation of a 10 ppm cleanup standard, for different levels of residual contamination and percent of cleanup area contaminated. When the contamination level is 10 ppm or less, the number in the table is the probability of a false positive, i.e., a false finding of noncompliance. These probabilities are all very low, as they should be. When the level is above 10 ppm, the number in the table is the probability that a violation will be detected by the sampling design. For levels close to 10 ppm, and for small percentages of cleanup area residually contaminated, the detection probability is low. When the level is high and the percent of area contaminated is large, however, detection probability approaches 100%. For small areas with high contamination, detection capability is modest. This is because there is only a small chance that the contaminated area will be sampled. Similarly, detection capability is also modest for large areas contaminated near the 10 ppm limit. The reason for this is that, even though a number of contaminated samples will be found in such cases, the analytical method is not likely to give positive identification of levels near the 10 ppm cutoff. This is the price paid for reducing the single-sample false positive rate to 0.5%.

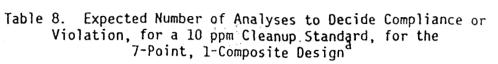
The second table for each compositing strategy shows the expected (average) number of analyses needed to reach a decision. For a fixed percent of area contaminated, the smallest number of analyses is needed if the level of contamination is very high or very low. For intermediate levels, more analyses are needed. The largest number of analyses are required with a large area contaminated at close to 10 ppm. In such a situation, the levels of the composite(s) will mostly lie in the intermediate range for which no conclusion is possible based on analysis of the composite. Thus, individual analyses will almost always be required, so that the advantage of compositing is lost.

Tables 13 through 20 compare the recommended compositing strategies for the 7-point and 19-point designs to alternative compositing strategies for these designs, for 4 different contaminated percentages (1%, 9%, 25%, and 49%). The comparison is based on the expected number of analyses required. Overall detection capabilities are comparable for the different strategies. The tables show that the recommended strategies are best, except for larger areas contaminated close to the 10 ppm level.

Table 7. Probability of Declaring a Violation of a 10 ppm Cleanup Standard, for the 7 Point, 1 Composite Design

Level of resid		Percent	of cleanu	ıp area wit	h residual	PCB conta	amination
(ppm)		1	4	9	16	25	49
Compliant	8	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
•	10	< 0.001	< 0.001	< 0.001	< 0.001	0.002	0.007
Noncompliant	11	< 0.001	< 0.001	< 0.001	< 0.001	0.009	0.032
•	12	< 0.001	0.001	0.001	0.002	0.017	0.092
	13	0.001	0.005	0.005	0.009	0.045	0.184
	14	0.003	0.010	0.019	0.028	0.085	0.298
	15	0.006	0.016	0.039	0.065	0.134	0.396
	- 16	0.009	0.029	0.064	0.102	0.202	0.517
	18	0.019	0.074	0.137	0.218	0.344	0.655
	20	0.030	0.110	0.199	0.335	0.479	0.787
	25	0.048	0.186	0.342	0.5 <b>54</b>	0.736	0.905
•	50	0.070	0.245	0.487	0.767	0.977	0.989
	75	0.071	0. <b>245</b>	0.496	0.787	0.992	0.995
	100	0.068	0 <b>.255</b>	0. <b>499</b>	0.800	0.995	0.997
	150	0.070	0 <i>.</i> <b>246</b>	0.481	0.796	0.998	0.999
	200	0.073	0.254	0.489	0.806	> 0.999	> 0.999
	300	0.069	0.257	0.494	0.792	> 0.999	> 0.999
	500	0.070	0.242	0.492	0.811	> 0.999	> 0.999

<sup>&</sup>lt;sup>a</sup>Seven samples analyzed first as a composite, then individually if necessary to reach a decision.



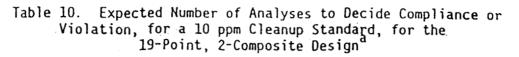
Level of residual PCB contamination (ppm)		Percent 1	of cleans	up area wit	h residual		
(pp)			4		16	25	49
Compliant	4	1.00	1.00	1.00	1.00	1.00	1.11
•	6	1.00	1.00	1.00	1.00	1.06	2.31
	8	1.00	1.00	1.00	1.00	1.44	3.96
	10	1.00	1.01	1.02	1.03	1.75	4.96
.Noncompliant	11	1.01	1.04	1.05	1.11	2.01	5.31
	12	1.04	1.08	1.17	1.32	2.21	5.39
	13	1.04	1.18	1.40	1.59	2.56	5.35
	14	1.10	1.32	1.63	2.02	2.86	5.18
	15	1.13	1.45	1.85	2.35	3.22	4.90
	16	1.15	1.52	2.03	2.67	3.50	4.71
	18	1.19	1.69	2.41	3.18	3.95	4.36
	20	1.24	1.85	2.57	3.59	4.19	4.04
	25	1.26	1.98	2.85	3.84	4.47	3.61
	50	1.28	1.96	2.93	3.99	4.45	2.96
	75	1.28	1.94	2.93	3.98	4.23	2.26
	100	1.21	1.79	2.53	3.45	3.54	1.87
	150	1.09	1.28	1.52	1.86	1.89	1.30
	200	1.03	1.11	1.15	1.34	1.33	1.13
	300	1.01	1.01	1.04	1.09	1.06	1.03
	500	1.00	1.00	1.01	1.02	1.02	1.01

<sup>&</sup>lt;sup>a</sup>Seven samples analyzed first as a composite, then individually if necessary to reach a decision.

Table 9. Probability of Declaring a Violation of a 10 ppm Cleanup Standard, for the 19 Point, 2 Composite Design

Level of residual PCB contamination		Percer	nt of clean	up area wi	ith residua	al PCB con	tamination
(ppm)		1	4	9	16	25	49
	<u> </u>						
Compliant	8	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
·	10	< 0.001	< 0.001	0.002	0.007	0.015	0.028
Noncompliant	11	< 0.001	< 0.001	0.007	0.034	0.058	0.017
•	12	0.001	0.002	0.029	0.084	0.153	0.281
	13	0.003	0.007	0.062	0.179	0.304	0.497
•	14	0.005	0.021	0.114	0.304	0.455	0.693
	15	0.012	0.052	0.178	0.407	0.606	0.832
	16	0.025	0.083	0.264	0.518	0.744	0.908
	18	0.046	0.167	0.421	0.698	0.883	0.978
•	20	0.077	0.263	0.556	0.812	0.945	0.993
	25	0.125	0.461	0.784	0.923	0.990	0.999
	50	0.161	0.631	0.978	0.992	0.999	> 0.999
	75	0.171	0.651	0.993	0.997	> 0.999	> 0.999
	100	0.168	0.642	0.99 <b>4</b>	0.999	> 0.999	> 0.999
	150	0.166	0.657	0.998	0.999	> 0.999	> 0.999
	200	0.175	0.648	0.999	0. <b>999</b>	> 0.999	> 0.999
	300	0.168	0.654	0.999	> 0.9 <b>99</b>	> 0.999	> 0.999
	500	0.180	0.661	0.999	> 0.999	> 0.999	> 0.999

aNineteen samples analyzed first as two composites, then individually if necessary to reach a decision.





Level of resi PCB contamina		Parcer	nt of clear		th mosidu	-1 0CD co-	• • • • • • • • • •
(ppm)	Cron	1	4	9	16	25	49
Compliant	4	2.00	2.00	2.00	2.18	3.30	7.49
	. 6	2.00	2.00	2.00	3.79	6.70	11.22
	8	2.00	2.00	3.01	6.15	9.20	13.18
	10	2.01	2.03	3.72	7.46	10.55	14.02
Noncompliant	11	2.03	2.14	4.07	7.90	10.74	13.81
•	12	2.10	2.32	4.57	8.08	10.67	12.78
	13	2.21	2.74	4.84	7.94	9.95	11.00
	14	2.25	3.02	5.16	7.90	9.31	9.27
	15	2.37	3.40	5.50	7.65	8.42	7.80
	16	2.49	3.84	5.89	7.30	7.59	6.63
	18	2.60	4.36	6.11	6.57	6.29	5.02
	20	2.68	4.65	6.26	6. <b>18</b>	5.48	4.25
	25	2.82	5.02	6.20	5.4 <b>5</b>	4.57	3.36
	50	2.80	5. <b>03</b>	5. <b>96</b>	4.70	3.48	2.28
	75	2.80	5.0 <b>5</b>	5.69	3.68	2.63	1.84
	100	2.77	4.95	5.37	3.46	2.26	1.69
	150	2.53	3.94	3.99	2.59	1.80	1.46
	200	2.21	2.67	2.61	1.91	1.55	1.33
	300	1.99	1.89	1.70	1.50	1.34	1.19
	500	1.92	1.69	1.48	1.39	1.30	1.16

<sup>&</sup>lt;sup>a</sup>Nineteen samples analyzed first as two composites, then individually if necessary to reach a decision.

Table 11. Probability of Declaring a Violation of a 10 ppm Cleanup Standard, for the 37 Point, 4 Composite Design

Level of residence PCB contaminate		Percent	of clean	un area wi	th residual	PCR cont	amination
(ppm)		1	4	9	16	25	49
Compliant	8 10	< 0.001 < 0.001	< 0.001 0.002	< 0.001 0.010	< 0.001 0.022	< 0.001 0.031	< 0.001 0.060
Noncompliant	11 12 13 14 15 16 18 20 25 50 75 100 150 200 300 500	0.001 0.005 0.012 0.023 0.039 0.091 0.147 0.249 0.340 0.343 0.353 0.353 0.357 0.344	0.008 0.024 0.053 0.094 0.159 0.242 0.390 0.542 0.771 0.976 0.991 0.993 0.997 0.996 0.997	0.041 0.103 0.224 0.360 0.501 0.621 0.785 0.884 0.958 0.997 0.999 0.999 > 0.999 > 0.999 > 0.999 > 0.999	0.084 0.217 0.388 0.575 0.740 0.831 0.940 0.981 0.995 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999	0.124 0.305 0.536 0.726 0.859 0.936 0.985 0.999 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999	0.225 0.488 0.751 0.908 0.950 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999 > 0.999

<sup>&</sup>lt;sup>a</sup>Thirty-seven samples analyzed first as four composites, then individually if necessary to reach a decision.



Table 12. Expected Number of Analyses to Decide Compliance or Violation, for a 10 ppm Cleanup Standard, for the 37-Point, 4-Composite Design

Level of resi PCB contamina			of clean		th residual		
(ppm)		1	4	9	16	25	49
Compliant	4	4.00	4.01	4.41	6.72	9.85	15.69
•	6	4.00	4.15	6. <b>66</b>	10.22	13.48	19.36
	8	4.00	4.77	9.01	12.76	15.98	<b>2</b> 2.08
	10	4.02	5.36	10.56	14.29	17.18	23.04
Noncompliant	11	4.07	5.69	10.87	14.29	16.93	21.28
•	12	. 4. 18	5. <b>97</b>	10.94	13.74	15.68	17.84
	13	4.35	6.28	10.56	12.74	13.44	13.54
	14	4.57	6 <b>.78</b>	10.21	11.21	11.13	10.10
	15	4.73	7.04	9.60	9.71	9.33	7.78
	16	4.90	7.33	9.08	8.77	7.83	6.12
	18	5. <b>09</b>	7.59	8. <b>02</b>	7.05	6.16	4.71
	20	5.26	7. <b>74</b>	7.28	6.26	5.30	3.96
	25	5. <b>34</b>	7. 5 <b>5</b>	6.53	5.28	4.37	3.08
	50	, <b>5.27</b>	7.14	5.39	3.78	3.06	2.16
	75	5.23	6. <b>84</b>	4.31	3.04	2.55	1.90
	100	5.22	6. <b>43</b>	3.73	2.64	2.32	1.73
	150	4.55	4.89	3.02	2.37	2.07	1.57
	200	3.95	3.57	2.53	2.15	1.90	1.52
	300	3.59	2.67	2.28	2.04	1.81	1.44
	500	3.49	2.48	2.22	1.99	1.79	1.44

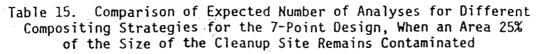
<sup>&</sup>lt;sup>a</sup>Thirty-seven samples analyzed first as four composites, then individually if necessary to reach a decision.

Table 13. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 7-Point Design, When an Area 1% of the Size of the Cleanup Site Remains Contaminated

Level of residual PCB contamination (ppm)		1 Composite	2 Composites	Individually	
Compliant	4	1.00	2.00	7.00	
•	8	1.00	2.00	7.00	
	10	1.00	2.00	7.00	
Noncompliant	12	1.04	2.02	6.98	
	14	1.10	2.05	6.96	
	16	1.15	2.07	6.92	
	20	1.24	2.10	6.88	
	25	1.26	2.11	6.84	
	50	1.28	2.09	6.80	
	100	1.21	1.98	6.78	
	200	1.03	1.96	6.80	
	500	1.00	1.96	6.81	

Table 14. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 7-Point Design, When an Area 9% of the Size of the Cleanup Site Remains Contaminated

Level of residual PCB contamination (ppm)		1 Composite	2 Composites	Individually	
Compliant	4	1.00	2.00	7.00	
	8	1.00	2.00	7.00	
	10	1.02	2.01	6.99	
Noncompliant	12	1.17	2.09	6.91	
•	14	1.63	2.32	6.69	
	16	2.03	2.50	6.49	
	20	2.57	2.77	6.05	
	25	2.85	2.79	5.65	
	50	2.93	2.60	5.45	
	100	2.53	1.85	5.46	
	200	1.15	1.72	5.45	
	500	1.01	1.17	5.45	
				-	



Level of residu contamination		1 Composite	2 Composites	Individually	
Compliant	4	1.00	2.00	7.00	
•	8	1.44	2.13	7.00	
	10	1.71	2.24	6.98	
Noncompliant	12	2.21	2.44	6.81	
•	14	2.86	2.84	6.29	
	16	3.50	3.23	5.64	
	20	4.19	3.54	4.68	
	25	4.47	3.56	4.12	
	50	4.45	2.97	3.58	
	100	3.54	1.61	3.51	
	200	1.33	1.38	3.50	
	500	1.02	1.37	3.50	

Table 16. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 7-Point Design, When an Area 49% of the Size of the Cleanup Site Remains Contaminated

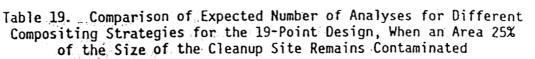
Level of residual PCB contamination (ppm)		1 Composite	2 Composites	Individually	
Compliant	4	1.11	2.02	7.00	
•	8	3.96	2.99	7.00	
	10	4.96	3.50	6.96	
Noncompliant	12	5.39	3.81	6.61	
·	14	5.18	3.94	5.79	
	16	4.71	3.86	4.82	
	20	4.04	3.49	3.53	
	25	3.61	3.03	2.87	
	50 ·	2.96	2.22	2.40	
	100	1.87	1.36	2.40	
	200	1.13	1.23	2.39	
	500	1.01	1.20	2.39	
				<b>7</b> € 1	

Table 17. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 19-Point Design, When an Area 1% of the Size of the Cleanup Site Remains Contaminated

Level of residual PCB contamination (ppm)		2 Composites	6 Composites	Individually	
Compliant	4	2.00	6.00	19.00	
•	8	2.00	6.00	19.00	
	10	2.01	6.00	19.00	
Noncompliant	12	2.10	6.03	18.93	
	14	2.25	6.07	18.74	
	16	2.49	6.11	18.46	
	20	2.68	6.07	18.06	
	25	2.82	6.01	17.75	
	50	2.80	5.80	17.49	
	100	2.77	5.56	17.46	
	200	2.21	5.53	17.46	
	500	1.92	5.57	17.46	

Table 18. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 19-Point Design, When an Area 9% of the Size of the Cleanup Site Remains Contaminated

contamination	al PCB (ppm)	2 Composites	6 Composites	Individually
Compliant	4	2.00	6.00	19.00
	8	3.01	6.19	19.00
	10	3.72	6.32	18.96
Noncompliant	12	4.57	6.54	18.40
•	14	5.16	6.74	16.90
	16	5.89	6.83	14.86
	20	6.26	6.33	11.89
	25	6.20	5.74	10.22
	50 .	5.96	4.45	8.94
	100	5.37	3.34	8.64
	200	2.61	3.17	8.63
	500	1.48	3.17	8.62
				•



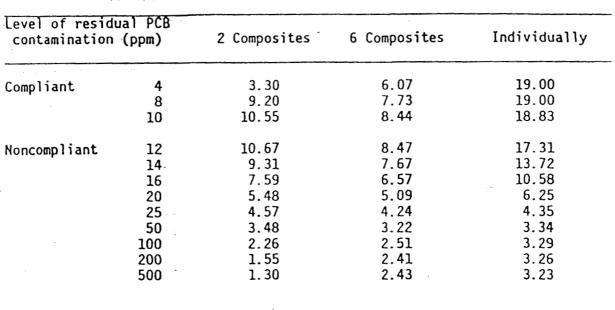


Table 20. Comparison of Expected Number of Analyses for Different Compositing Strategies for the 19-Point Design, When an Area 49% of the Size of the Cleanup Site Remains Contaminated

Level of residu contamination		2 Composites	6 Composites	Individually
Compliant	4	7.49	6.28	19.00
•	8	13.18	9.85	19.00
	10	14.02	10.84	18.73
Noncompliant	12	12.78	10.10	16.15
	14	9.27	7.78	11.34
	16	6.63	5.87	7.14
	20	4.25	3.92	3.74
	25	3.36	3.23	2.61
	50	2.28	2.46	2.10
	100	1.69	1.85	2.06
	200	1.33	1.79	2.04
	500	1.16	1.78	2.02
				*

The major conclusions that can be drawn from these results are as First, the proposed cutoff on the measured PCB level for a finding of noncompliance for a single sample, 14.2 ppm, is successful in controlling the overall false positive rate of the sampling scheme. For example, when an area half the size of the entire site remains contaminated just at the allowable limit of 10 ppm, the false positive rate is 1% for the 7-point design, 3% for the 19-point design, and 6% for the 37-point design. Note, that the overall false-positive rate is highest for contamination just at the allowable limit. Second, the detection capabilities of the design appear satisfactory, bearing in mind the difficulty of detecting randomly-located contamination by any sampling scheme without exhaustive sampling. As an example, the proposed 19-point design can detect 50 ppm contamination present in 9% of the cleanup area with 98% probability. Similarly, the 19-point design can detect 20 ppm contamination present in 25% of the area with 95% probability. Third, the proposed compositing strategies are quite effective in reducing the number of analyses needed to reach a decision in all cases except those involving large areas contaminated near the cutoff of 10 ppm. For example, for contaminated levels of 25 ppm or greater, the expected number of analyses to reach a decision never exceeds 5 for the 7-point design, or 7 for the 19point design, or 8 for the 37-point design. Larger number of analyses are needed in cases of contamination close to the allowable limit of 10 ppm, up to 23 for the 37-point design when 49% of the area is contaminated at 10 ppm.

## B. Sampling Techniques

The types of media to be sampled will include soil, water, vegetation and solid surfaces (concrete, asphalt, wood, etc.). General sampling methods are described below. Additional sampling guidance documents are available (Mason 1982, USWAG 1984).

## Solids Sampling

When soil, sand, or sediment samples are to be taken, a surface scrape samples should be collected. Using a 10 cm x 10 cm (100 cm²) template to mark the area to be sampled, the surface should be scraped to a depth of 1 cm with a stainless steel trowel or similar implement. This should yield at least 100 g soil. If more sample is required, expand the area but do not sample deeper. Use a disposable template or thoroughly clean the template between samples to prevent contamination of subsequent samples. The sample should be scraped directly into a precleaned glass bottle. If it is free-flowing, the sample should be thoroughly homogenized by tumbling. If not, successive subdivision in a stainless steel bowl should be used to create a representative subsample.

In some cases, such as sod, scrape samples may not be appropriate. For these cases, core samples, not more than 5 cm deep, should be taken using a soil coring device. These core samples should be well-homogenized in a stainless steel bowl by successive subdivision. A portion of each sample should then be removed, weighed and analyzed.

Samples should be stored in the dark at 4°C in precleaned glass bottles. If samples are to be analyzed quickly, the storage requirements may be relaxed as long as sample integrity is maintained. Before collection of

verification samples, this equipment must be used to generate a field blank as described in Section IV.E.



#### 2. Water Sampling

#### a. Surface Sampling

If PCBs dissolved in a hydrocarbon oil were spilled, they will most likely be dispersed on the surface. Therefore, a surface water collection technique should be used. Surface water samples should be collected by grab techniques. Where appropriate, the precleaned glass sample bottle may be dipped directly into the body of water at the designated sample collection point. A sample is collected from the water surface by gently lowering a precleaned sample bottle horizontally into the water until water begins to run into it. The bottle is then slowly turned upright keeping the lip just under the surface so that the entire sample is collected from the surface.

#### b. Subsurface Sampling

If the PCBs were in an Askarel or other heavier-than-water matrix, the PCBs will sink. In these cases water near the bottom should be collected. To collect subsurface water, the bottle should be lowered to the specified depth with the cap on. The cap is then removed, the bottle allowed to fill, and the bottle brought to the surface.

## Other Sampling Approaches

When the above approaches are not feasible, other dippers, tubes, siphons, pumps, etc., may be used to transfer the water to the sample bottle. The sampling system should be of stainless steel, Teflon, or other inert, impervious, and noncontaminating material. Before collection of samples, this equipment must be used to generate a field blank as described in Section IV.E.

## d. Sample Preservation

The bottle is then lifted out of the water, capped with a PTFEor foil-lined lid, identified with a sample number, and stored at approximately 4°C (USEPA 1984a) until analysis to retard bacterial growth. If samples are to be analyzed quickly, the storage requirements may be relaxed as long as sample integrity is maintained.

## Surface Sampling

## a. Wipe Samples

If the surface to be sampled is smooth and impervious (e.g., rain gutters, aluminum house siding), a wipe sample should indicate—whether the cleanup has sufficiently removed the PCBs. These surfaces should be sampled by first applying an appropriate solvent (e.g., hexane) to a piece of 11 cm filter paper (e.g., Whatman 40 ashless, Whatman 50" smear tabs, or equivalent) or gauze pad. This moistened filter paper or gauze pad is held withmanpair of stainless steel forceps and used to thoroughly swab a 100-cm<sup>2</sup> area as measured by a sampling template.

Care must be taken to assure proper use of a sampling template. Different templates may be used for the variously shaped areas which must be sampled. A  $100~\rm cm^2$  area may be a  $10~\rm cm$  x  $10~\rm cm$  square, a rectangle (e.g.,  $1~\rm cm$  x  $100~\rm cm$  or  $5~\rm cm$  x  $20~\rm cm$ ), or any other shape. The use of a template assists the sampler in the collection of a  $100~\rm cm^2$  sample and in the selection of representative sampling sites. When a template is used it must be thoroughly cleaned between samples to prevent contamination of subsequent samples by the template.

The wipe samples should be stored in precleaned glass jars at 4°C. Before collection of verification samples, the selected filter paper or gauze pad and solvent should be used to generate a field blank as described in Section IV.E.

## b. Sampling Porous Surfaces

Wipe sampling is inappropriate for surfaces which are porous and would absorb PCBs. These include wood and asphalt. Where possible, a discrete object (e.g., a paving brick) may be removed. Otherwise, chisels, drills, saws, etc., may be used to remove a sufficient sample for analysis. Samples less than 1 cm deep on the surface most likely to be contaminated with PCBs should be collected.

#### 4. Vegetation Sampling

The sample design or visual inspection may indicate that samples of vegetation (such as leaves, bushes, and flowers) are required. In this case, samples may be taken with pruning shears, a saw, or other suitable tool and placed in a precleaned glass bottle.

#### C. Analytical Techniques

A number of analytical techniques have been used for analysis of PCBs in the types of samples which may be associated with PCB spills. Some of the candidate analytical methods are listed in Table 21. The analysis method(s) most appropriate for a given spill will depend upon a number of factors. These include sensitivity required, precision and accuracy required, potential interferents, ultimate use of the data, experience of the analyst, availability of laboratory equipment, and number of samples to be analyzed.

As shown in Table 21, many analytical methods are available. The general analytical techniques are discussed and then compared below.

## Gas Chromatography (GC)

As can be seen in Table 21, analysis of PCBs by gas chromatography is frequently the method of choice. PCBs are chromatographed using either packed or capillary columns and may be detected using either specific detectors or mass spectrometry. A comprehensive method for analysis of PCBs in transformer fluid and waste oils was developed by Bellar and Lichtenberg (1982). This method describes six different cleanup techniques, recommends three GC detectors, and suggests procedures for GC calibration and for measurement of precision and accuracy. This method also discusses several calculation methods.

			Table 21. St	Standard Procedures of Analysis for PCDs.	of Analysis fo	r PCDs			
Mater		Extraction	1	Determination method	Qualitative assessment	Quantitation method	8	8	
Mater   CH,Cl.   (Floristi)   FGC/ECO   No	3 J.S.	Hexane/CH <sub>2</sub> C1 <sub>2</sub>	(Floristi) (Silica Gel)	PGC/ECD <sup>d</sup>	Ş	Total area or	0.1 119/L	No ox	ASTM 19812
Mater		CH2C18	(Florisi) (S removal)	PGC/£CD	o X	Area	0.04-0.15 µg/L	<b>;</b>	EPA, 1984s;
Water         Hexana         Florisity         PGC/ED         Yes         Summed areas         HS         Yes         Hes         Yes         Yes         Yes         Hes         Hes         Yes         Yes         Yes <td></td> <td>CH<sub>8</sub>C1<sub>8</sub></td> <td><b>N</b></td> <td>PGC/E1HS (CGC)</td> <td>, ,</td> <td>Area</td> <td>30-36 µg/L</td> <td><b>\$</b></td> <td>Longbottom and Lichtenberg, 19 EPA, 1984b; Longbottom and</td>		CH <sub>8</sub> C1 <sub>8</sub>	<b>N</b>	PGC/E1HS (CGC)	, ,	Area	30-36 µg/L	<b>\$</b>	Longbottom and Lichtenberg, 19 EPA, 1984b; Longbottom and
Water         Several         Several         IRGC/EINS         Yes         Ind. peaks         Yes         Yes           Water         Hexane         (H-5Q4)         PGC/ECD         Ho         Single peak or         2 ppm         Yes           Maker         Hexane         Alumina         PGC/ECD         Ho         Individual or         2 ppb         Ho           Water         Hexane         Silica gel         PGC/ECD         Ho         Individual or         2 ppb         Ho           Water         Hexane         Silica gel         PGC/ECD         Ho         NS         106 ng/L         Ho           Maker         Hexane         Silica gel         PGC/ECD         Ho         Total area         NS         Yes           Mater         Hexane         Silica gel         PGC/ECD         Ho         Total area         NS         Yes           Solids and         Several         Several         HRGC/EIHS         Yes         Ind. peaks         HS         Yes           Silica gel         Finitisil,         HRGC/EIHS         Yes         Area         HS         Yes         H		Hexane/ CH <sub>2</sub> Cl <sub>2</sub> (85/15)	Fiorisil/ silica gel (CH <sub>3</sub> CH) (5 removal)	PGC/ECD or HECD	, Kes	Summed areas or Webb-McCall	S.	Yes.	Lichtenberg, 1982 EPA, 1978
Water         Hexane         (H <sub>2</sub> SQ <sub>4</sub> ) (Saponification)         PGC/ECD         Ho         Single peak or 2 ppm         Yes           Mater         Hexane         Alumina         PGC/ECD         Ho         Individual or 2 ppb         Ho           Mater         Hexane         Alimina         PGC/ECD         Ho         Ho         Individual or 2 ppb         Ho           Air         Mater         Hexane         Silica gel         PGC/ECD         Ho         HS         106 ng/L         Ho           Air         Billica gel         PGC/ECD         Ho         India area         HS         Yes         Yes           Solid sand         Several         Several         HRGC/EIHS         Yes         Ind. peaks         HS         Yes           Silica gel         Florisil,         HRGC/EIHS or Yes         Yes         Area         KS         Yes	Valer ducts)	Severa]	Several	IIRGC/E1MS	, ,				frickson et al.
Water         Hexane         Alumina         PGC/ECD         No         Individual or 2 ppb         Ho           Mater         Hexane         \$11ica gel         PGC/ECD         No         NS         106 ng/L         Ho           Air         Water         Hexane         (H <sub>2</sub> SQ <sub>4</sub> )         PGC/ECD         No         NS         106 ng/L         Ho           Solids         and Several         Several         HRGC/EIMS         Yes         Ind. peaks         NS         Yes           Splüdge         CH <sub>2</sub> Cl <sub>2</sub> Florisil, Florisil, PGC/EIMS         PGC/EIMS         Yes         Area         NS         Yes	-	Hexane	(H <sub>2</sub> 50 <sub>4</sub> ) (Saponification) Alumina	PGC/EC0	2	Single peak or summed peaks	2 ppm		1984, 1983d; EPA, 1984c AMSI, 1974
Water Hexane Silica gel PGC/ECD No MS 106 ng/L Mo Ms Ms 106 ng/L Mo Ms Ms 106 ng/L Mo Mater Hexane (H <sub>2</sub> SO <sub>4</sub> ) PGC/ECD Mo Total area MS Yes Soiling and Several HRGC/EIMS Yes Ind. peaks MS Yes Silica gel, PGC/EIMS or Yes Area MS Yes or GPC or GPC		Hexane	Alumina	PGC/EC0		Individual or total peak	2 ppb	£	Moein, 1976
Mater Di Mexane (H <sub>2</sub> SO <sub>4</sub> ) PGC/ECD No Total area MS Yes Solis H <sub>2</sub> O/CH <sub>3</sub> CM (Saponification) (Alumina) (A	Mater Mater	Нехале	Silica gel	PGC/ECD	-	Me lohts 45	106 mg/L	<b>£</b>	UK-DOE, 1979; Deventsh and
Solids and Several HRGC/EIMS Yes Ind. peaks MS Yes liquids  Sjudge CH2Cl2 Florisil, HRGC/EIMS or Yes Area MS Yes Yes or GPC or GPC		DI Hexane H <sub>2</sub> O/CH <sub>3</sub> CM	(H <sub>3</sub> 50 <sub>4</sub> ) (Saponification) (Alumina)	PGC/ECD .		otal area	\$2		Har I Ing-Boven, 1980 ASIM, 1981b
Slidge CH <sub>2</sub> Cl <sub>2</sub> Florisil, HRGC/EIMS or Yes Area MS Yes Yes Or GPC or GPC	(60)	Several	Several	HRGC/E1HS		nd. peaks	XX SX		rrickson et
_	9000 (s s-929		Florisil, Silica gel, or GPC	HRGC/ETHS or PGC/ETHS		<b>2</b>	Š		1985a laile and opez-Avilla, 984

	Procedure				(Panil Ca (Continued)	( paned )				
Sludge   Haane/ GPC	des ignation		Extraction	Cleaning	Determination method	Qualitative assessment	Quantitation	2	8	
Studge   CH,CL)   CPC   CCC/FIHS   Yes   NS   NS   Yes   Yes   Yes   And rest   And re	EPA (Halocarbon)		Hexane/ CH <sub>2</sub> C1 <sub>2</sub> / acetone (83/15/2)	GPC 5 removal	PGC/ECD	ؠۏ	Peak area or peak height		discussed Yes	Rodriguez et al., 1980
Solid waste   CH <sub>2</sub> CI <sub>2</sub>   (Floristi)   Silica get   Or PGC/CIMS   No Area   No Yes	Priority Pollutant	S ludge		<b>3</b> 8	rgc/E1HS	ج ج	Ñ	ž	بر بر بر	E?A, 1979c
Solid waste         CH <sub>2</sub> Cl <sub>2</sub> (Florisli)         PCC/ELMS         No         Area         1 µg/g         Yes           Solid waste         CH <sub>2</sub> Cl <sub>2</sub> None         PCC/ELMS         No         NS         1 µg/g         Yes           Solid waste         CHCl <sub>2</sub> None         CCC/ELMS         No         NS         1 µg/g         Yes           Unspecified         Hexane/ (Florisli)         (CHCKN) (Florisli)         PCC/ECG         No         Inal area or (Florisli)         NS         Yes           Sediment         CH <sub>2</sub> CM         FID/ELM         PCC/ECG         No         Computer         NS         Yes           Sediment         CH <sub>2</sub> CM         Saponification         PCC/ECG         No         Individual or Individual or         2 ppb         No           Sediment         CH <sub>2</sub> CM         Saponification         PCC/ECG         No         Single peak         Yes           Affication         H <sub>2</sub> SQ         Alumina         PCC/ECG         No         Single peak         Yes           Affication         H <sub>2</sub> SQ         Alumina         PCC/ECG         No         Single peak         Yes           Affication         H <sub>2</sub> SQ         Alumina         PCC/ECG         No <td>100</td> <td>Sludge</td> <td></td> <td></td> <td>HRGC/E1HS or PGC/E1HS</td> <td>Yes</td> <td>NS</td> <td>×</td> <td>Yes</td> <td>Ballinger, 197</td>	100	Sludge			HRGC/E1HS or PGC/E1HS	Yes	NS	×	Yes	Ballinger, 197
Solid waste         CHC1         Mone         PGC/EIMS         No         NS         1 µg/g         Yes           Unspecified         Hexane/ (Clorisii)         (Clorisii)         PGC/ECD         No         1 µg/g         Yes           Soll and Acetone/ (Silica gel)         (Clorisii)         PGC/ECD         No         Total area or NS         NS         Yes           Soll and Acetone/ (Silica gel)         Florisii         PGC/ECD         No         Computer         NS         Yes           Soll and Acetone/ (Hxane Silica gel)         FGC/ECD         No         Individual or NS         Yes         Yes           Sediment (Hxane Silica gel)         FGC/ECD         No         Individual or NS         Yes         Yes           Sediment (Hxane Silica gel)         FGC/ECD         No         Single peak or 2 pow NS         Yes           Afracial peak or Forisil or Alumina         FGC/ECD         No         Single peak or 2 pow NS         Yes           Afracial peak or Pairs (Florisii)         FGC/ECD         No         Single peak or 2 pow NS         Yes           Afracial peak or C/ECD         No         Single peak or 2 pow NS         Yes         Yes           Afracial peak or C/ECD         No         Single peak or 2 pow NS         Yes	8250	Solid waste	<b>6</b> ,0	(Florisii)	PGC/ECD	8	Area	1 10/0	Yes	EPA. 1982.
Unspecified Hexane/ (CH3CN) COCCEO NO Total area or NS NO Soil and Acetone (Florisi) PGC/ECD NO Computer NS For Sediment CH3CN Saponification PGC/ECD NO Computer NS For Sediment CH3CN Saponification PGC/ECD NO Individual or 2 ppb No H4SOI Alumina Alumina Africal Research (H3SOI H3SOI (Florisii) PGC/ECD NO Single peaks or 2 ppa Yess Africant Alumina PGC/ECD NO For Ind. Peaks NS For Sediment CH3CN Saponification PGC/ECD NO Single peaks or 2 ppa Yess Africant Alumina Africant PGC/ECD NO For Ind. Peaks NS For Signes Peaks NS For For Figures on For Single peaks NS For For Figures on For Single peaks NS For For Figures on For For Ind. Peaks NS For For Figures on For For Figures on For For For Figures Col-  Indicated on Pure National PGC/ECD NO For For For For For For Figures Col-  Indicated on Pure National PGC/ECD NO For	0,23	Solid waste	CHC)	Mone Mone	PGC/EIMS	<b>S</b>	KS	1 μ9/9	Yes	EPA, 1982e
Sediment Acetone/ Floristi PGC/ECD No Computer NS Yes (Stemoval) Sediment CH <sub>2</sub> CM Saponification PGC/ECD No Individual or 2 ppb No H <sub>2</sub> So <sub>4</sub> Alumina Sediment, CH <sub>3</sub> CM Saponification PGC/ECD No Individual or 2 ppb No Single peak or 2 ppm Yes Alumina Afr collected Hexane (H <sub>3</sub> So <sub>4</sub> ) Afr collected Hexane (H <sub>3</sub> So <sub>4</sub> ) Afr collected Hexane (H <sub>3</sub> So <sub>4</sub> ) Afr near haz Hexane (H <sub>3</sub> So <sub>4</sub> ) Afr near haz Hexane Alumina PGC/ECM No Iotal area or 10-50 ng/m³ No Files collected on Puf	A (sp[11s)		Hexane/ acetone	(CH <sub>3</sub> CN) (Florisil) (Silica gel)	PGC/ECD	£ £	MS Total area or Webb-McCall	1 1-9/9 XS	¥ &	ErA, 1982e Beard and Schaum, 1978
Sediment CH3CM Saponification PGC/ECD No Individual or 2 ppb No Hamina Sediment, CH3CM Saponification PGC/ECD No Single peak or 2 ppm Yes soil H2SO, Atumina Airmina PGC/ECD No Single peak or 2 ppm Yes on Florisii or Airmina PGC/ECD No Ind. peaks NS Yes Airmina PGC/ECD No India area or 10-50 ng/m³ No India	EPA	Soff and Sediment	Acetone/ Hexane	Floristi Silica gel (\$ removal)	PGC/ECD		Computer	Š	Ϋ́ς s	EPA, 1982d
Sediment, CH <sub>3</sub> CM Saponification PGC/ECD Ho Single peak or 2 ppm Yes Airmina Airmina PGC/ECD Ho Single peak or 2 ppm Yes Airmina HRGC/EIMS Yes Ind. peaks MS Yes Airmina PGC/ECO Ho Total area or 10-50 mg/m³ Mo Tested on PUF	Monsanto	Sediment		Saponification H <sub>2</sub> SO Alumina	PGC/ECD		Individual or total peak	9dd ~	£	Moeln, 1976
Afr collected Hexane (H <sub>2</sub> SO <sub>4</sub> ) HRGC/EIMS Yes Ind. peaks MS Yes Yes XAD-2 XAD-2 Afr near haz - Hexane/ Alumina PGC/ECO Mo lotal area or 10-50 ng/m³ Mo Yestes col- lécted on PUF	ANS I	Sediment, soil		Saponification Hz SO Aiumina	PGC/ECD		heights Single peak or tummed peaks	2 pps		AMS1. 1974
Air near haz- Hexane/ Aiumina PGC/ECO No Total area or 10-50 ng/m³ No Fsites col- Psites col- Pur	fPA (by- products)	Air collected on Florisii or XAD-2	Hexane	(H <sub>1</sub> SO <sub>4</sub> ) (Floris11)	HRGC/E1MS		'nd. peaks	Š		Erickson et al.
	Cambient	Air near haz- ardous waste Failes col- Tected on PUF	>	Alumina	PGC/EC0		olal area or eak height	10-50 ng/m³		1962, 1983d; Erickson, 1984b Lewis, 1982

Procedure				Table 21 (Continued)	'uued)				
designation	Matrix	Extraction	Cleanup <sup>C</sup>	Determination method	Qualitative assessment	Quantitation method	1 2	8	
EPA (stack)	Incinerator ewissions and ambient air collected on Florisi	Hexan	(H <sub>2</sub> SO <sub>4</sub> )	Perchloring- Lion PGC/ECD	10	Area	10 ng	discussed %	Reference Haile and Baladi, 1977; Beard and Schaum.
EPA	Compustion sources collected on Florisii	Pentane or CH2CI3	(floristl/ silica gel)	PGC/HS	٤	Area/homolog	0.1 ng/inj	\$	1978 Levins et al., 1979
EPA (incin- erators)	Stack gas	Pentane/ methanol		PGC/HS	, ,	Single peak	×	2	
1SW	Air (toluene impinger)	•	(H <sub>2</sub> SO <sub>4</sub> ) (Saponification) (Alumina)	PGC/EC0	8	Single peak	qdd 2	<b>.</b>	Schaum, 1978 AKSI, 1974
(P&CAM 244)	Air collected on Florisi	Hexane	Kone	PGC/ECD	Š	Peak height or area from stan- dard curve or webb-wores	0.01 mg/m³	£	HIOSH, 1977a
(PLCM: 753)	Air collected on Flarisii	Hexane	Mone	PGC/ECD Perchloring- tion	ž	Peak height or area from stan-	0.01 mg/m³	£	K10SII, 1977b,c
	Matural gas sampled with Florisil	Hexane	H <sub>2</sub> 50 <sub>4</sub>	PGC/ECD		Total area, peak height or Webb-	0.1-2 ид∕м³	<b>.</b>	Harris et al., 1981
EPA [5,A,(3)] 81000	8 1 00d	Hexane	(Flor(s 1)	000/004		(Perchlorination)			
EPA [5,A,(1)] Adipose	Adipose	Pet. ether/ CH <sub>3</sub> CM	Floristi	PGC/ECD	2 £	85 85 85	X X	<b>9</b> 5	Vatts, 1980
(a,v)	Adlpose	Pet. ether/ CH <sub>3</sub> CM	Saponification Florisii	11.0	No	Semiquant.	10 ppm	æ	Valls, 1980
		Acetone/ hexane	CH <sub>3</sub> CM Florisil Silica acid	PGC/£CD	γ <b>ε</b>	Ind. peaks	\$ \$	, ,	Watts, 1980 Sherma, 1981

Food CH, DW/Pet. Florist! Mgo/ PGC/ECO No lotal area or support and Supportication Charaction Charaction Charaction Charaction Charaction Charaction Character Silica gel Supportication Character C					Table 21 (Continued)	inved)				
CHyCHCE	des Ignatio		Extraction	Cleanup <sup>C</sup>	Determination method	Qualitative assessment	Quantitation	8	8	
Food Pet, ether' Silica gel FCC/ECO Yes Sumed areas  Graduation  Food "Pet, ether' Silica gel (Florisi)  Food "Pet, ether' Silication (FCC/ECO)  Graduation (Saponification)  Food (Saponification)  Food (Saponification)  Capacitor  Capacitor  Saponification  Saponification  Capacitor  Saponification  Saponification  Capacitor  Saponification  Saponif	ADAC (29)	8	CH <sub>3</sub> CH/Pet.	Floristi MgO/ Celite Saponification	PGC/£CD	Š	Total area or Ind. peaks	1	No No	AGAC, 1980a
Food 'Pet. ether' Silicic acid (CAC/ECO) Ho Area  (Seponification) (PGC/HECO)  (Paper and Saponificat  (Porisi) (PF-1LC)  (Porisi) (Porisi) (PGC/HECO)  Askarels  (Askarels  (As	Jepen	<b>. 6</b>	Pet. ether/ CH <sub>3</sub> CM		PGC/ECD	× × ×	Summed areas perchlorination	Š	£	Tanabe, 1976
Paper and Saponifica- Florisii MgO/ PGC/ECD No lotal area or Saponification Saponification Called District Cal	₹.	<b>2</b>	Pet. ether/ Chack	Silicic acid (Saponification) (Oxidation) (Florisil)		2	Ares	S.	£	FDA, 1977
Askarels  Askarels  Mineral oil Dilute with Florisii slurry  Mineral oil Dilute with Florisii slurry  Mineral oil Dilute with Florisii slurry  FECCHECO  Transformer  Di (H-504)  Transformer  Transformer  Di (H-504)  Transformer  Transformer  Di (H-504)  Transformer  Transform	OAC (23)	Paper and paperboard	Saponifica- tion	Florisil MgO/ Cellice Seponification	PGC/ECD	<b>.</b>	Total area or Ind. peaks	a S M	£	AOAC, 19806
Mineral oil Dilute with Florisii slurry PGC/FCO Yes Ind. peaks or Isooctane (Florisii column) (PGC/HECO) Yes Ind. peaks or Isooctane (Florisii column) (PGC/HECO No Iotal area or (Musina) (Florisii) or /FCO or Webb-HCCail (Alumina) (Alumina) /FINS (Alumina) (Alumina) (Alumina) /FINS (Alumina) (Alumina) (Alumina) /FINS (Alumina) (Alumin	3303-74	Capacitor Askarels	q10	Kone	SCOT HRGC/FID	£	Total area	2.8 x 10" = mo1/L	£	ASTM, 1980a
Transformer [1] (H,SQ,) PGC/HECO No Total area or fluids or (Florisi) or /ECD or /ECD or Web-McCail (Alumina) /EINS (Silica gel) (HRGC) (GPC), (CH <sub>3</sub> CN) Yes Ind. peaks 3 pigment A. Hexane/ None PGC/ECN No 10 iscers B. CH <sub>3</sub> Cl <sub>2</sub> Florisii Chlorinated DI None PGC/ECN Yes Total peak height/homology Winspecified Not addressed Not addressed HRGC/EINS Yes Ind. peaks	1059-83		Dilute with hexane or isooctane	Floristi slurry (H <sub>2</sub> SO <sub>4</sub> ) (Floristi column)		¥ .	Ind. peaks or Webb-McCall	\$0 bb	£	ASTM, 1983
Products or Several Several HRCC/EIMS Yes Ind. peaks 3 pigment A. Hexane/ None PGC/ECD No 10 issuers types B. CH <sub>2</sub> Cl <sub>2</sub> Fiorisil PGC/EIMS Yes Total peak benzenes Unspecified Not addressed Not addressed HRCC/EIMS Yes Ind. peaks	(i) <b>x</b>	,	<b>a</b>	(H <sub>2</sub> SQ <sub>4</sub> ) (Florist1) (Alwins) (SI 11ca ge1) (GPC), (CH <sub>3</sub> CN)			Total area or Webb-McCall	1 20/kg	, ,	EPA, 1981 Bellar and Lichtemberg,
Jelgment A. Hexane/ None PGC/ECD No 10 isceers types B. CH2Cl2 Florisii Chlorinated D1 None PGC/EIHS Yes Total peak benzenes height/homolog Unspecified Not addressed MoLaddressed HRCC/EIHS Yes Ind. peaks	A (by- oducts)	Products or wastes	Several	Several	HRGC/E1MS		Ind. peaks	X	, ,	Erickson et al.,
Chlorinated D1 None PCC/EIHS Yes Total peak benzenes Unspecified Not addressed Not addressed HRCC/EIHS Yes Ind. peaks	<b>.</b>	3 ploment types	A. Hexane/ H <sub>2</sub> SO <sub>4</sub> B. CH <sub>2</sub> Ci <sub>2</sub>	Mone Florisii	PGC/ECD		10 iscers	* 1 pps/hosellog	<b>.</b>	1962, 1963d; Erickson, 1964a DCMA, 1962
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Source: M. D. Erickson, The Analytical Chemistry of PCBs, Bullerworths, Boston, HA, 1985, in press.

a Mo specific details.

b Direct injection or dilute and inject.

c Techniques in parentheses are described as optional in the procedure.

d Or PGC with microcoulometric or electrolytic conductivity.

#### a. Gas Chromatograph/Electron Capture Detection

Packed column gas chromatography with electron capture detection (GC/ECD) is generally the method of choice for analysis of spill site samples, transformer oils, and other similar matrices which must be analyzed for PCB content prior to disposal (Copland and Gohmann 1982). GC/ECD is very sensitive, highly selective against hydrocarbon background, and relatively inexpensive to operate. The technique is most appropriate when the PCB residue resembles an Aroclor® (Aroclor® is a registered trademark of Monsanto Company; the trademark designation is not used throughout this report) standard and other halogenated compounds do not interfere.

While it is considered a selective detector, ECD also detects non-PCB compounds such as halogenated pesticides, polychlorinated naphthalenes, chloroaromatics, phthalate and adipate esters, and other compounds. These compounds may be differentiated from PCBs only by chromatographic retention time. Elemental sulfur can interfere with PCB analysis in sediment and other samples which have been subjected to anaerobic degradation conditions. There are also common interferences which do not give discrete peaks. An example of a nonspecific interference is mineral oil (ASTM 1983). Mineral oil, a complex mixture of hydrocarbons, can cause a general suppression of ECD response. Mineral oils from transformers often contain PCBs as a result of cross-contamination of transformer oils.

A major disadvantage of ECD is the range of response factors which different PCB congeners exhibit. Zitko et al. (1971) and Hattori et al. (1981) published response factors ranges of about 540 and 9000, respectively. Boe and Egaas (1979), Onsuka et al. (1983) and Singer et al. (1983) have also published ECD response factors. The range of response factors seriously inhibits reliable quantitation of individual PCB congeners or non-Aroclor PCBs unless the composition of the sample and standard are the same.

When PCBs are analyzed by packed column gas chromatography. the PCBs are usually quantitated by total areas or individual peaks. In the total areas method, the areas of all peaks in a retention window are summed and this total compared with the corresponding response of an Aroclor standard. With the individual peak quantitation method, response factors are calculated for each peak in the packed column chromatogram. The most prominent individual peak quantitation method was originated by Webb and McCall (1973). These results may be reported as an Aroclor concentration or as total PCB. Packed column GC techniques are generally useful for quantitation of samples which resemble pure Aroclors but are prone to errors from interfering compounds or from PCB mixtures that do not resemble pure Aroclors (Albro 1979). For this reason analysts have been using capillary gas chromatography for the analysis of PCBs. Capillary gas chromatography offers the analyst the ability to separate most of the individual PCB isomers. Bush et al. (1982) has proposed a method of obtaining "total PCB" values by integration of all PCB peaks, using response factors generated from an Aroclor mixture. Zell and Ballschmiter (1980) have developed a simplified approach where only a selected few "diagnostic peaks" are quantitated. In a similar approach Tuinstra et al. (1983) have quantitated six specific, diagnostic congeners which appear to be useful for regulatory cutoff analyses.

## b. GC/Hall Electrolytic Conductivity Detector

Electrolytic conductivity detectors have also been used with packed column gas chromatography to selectively detect PCBs (Webb and McCall 1973. Sawyer 1978). The Hall electrolytic conductivity detector (HECD) measures the change in conductivity of a solution containing HCl or HBr which is formed by pyrolysis of halogenated organic GC effluents. The HECD exhibits 105-106 selectivity for halogenated compounds over other compounds. It also gives a linear response over at least a 103 range. HECD and ECD were compared for their use in detecting PCBs in waste oil, hydraulic fluid, capacitor fluid, and transformer oil (Sonchik et al. 1984). They found both detectors acceptable, but noted that the HECD gave higher results with less precision than the ECD. The method detection limits ranged from 3-12 ppm for HECD and 2-4 ppm for ECD. Greater than 100% recovery of spikes analyzed by HECD indicated a nonspecific response to non-PCB components, since extraneous peaks were not observed. Another comparison of HECD and ECD for the analysis of PCBs in oils at the 30-500 ppm levels found that the type of detector made no significant difference in the results (Levine et al. 1983). The authors noted that they had expected higher accuracy from the more specific HECD. They postulated that the cleanup procedures (Florisil, alumina, and sulfuric acid) all had effectively removed the non-PCB species which would have caused interferences in the ECD and reduced its accuracy.

#### c. GC/Mass Spectrometry

Highly specific identification of PCBs is performed by GC with mass spectrometric (GC/MS) detection. High resolution gas chromatography is generally used with mass spectrometry, so individual PCB isomers may be separated and identified. A GC/MS produces a chromatogram consisting of data points at about 1 second intervals, which are actually full mass spectra. The data are stored by a computer and may be retrieved in a variety of ways. The data file contains information on the amount of compound (signal intensity), molecular weight (parent ion), and chemical composition (fragmentation patterns and isotopic clusters).

GC/MS is particularly suited to detection of PCBs because of its intense molecular ion and the characteristic chlorine cluster. Chlorine has two naturally occurring isotopes,  $^{35}$ Cl and  $^{37}$ Cl, which occur in a ratio of 100:33. Thus, a molecule with one chlorine atom will have a parent ion, M, and an M+2 peak at 33% relative intensity. With two chlorine atoms, M+2 has an intensity of 66% and M+4, 11%.

Because of its expense, complexity of data, and lack of sensitivity, GC/MS has not been used as extensively as other GC methods (particularly GC/ECD), despite its inherently higher information content. As the above factors have been improved, GC/MS has become much more popular for analysis of PCBs, and will probably continue to increase in importance. Several factors including the introduction of routine instruments without costly accessories, decreasing data system costs, and mass-marketing, have combined to keep the costs of GC/MS down while prices of other instruments have risen steadily. With larger data systems and more versatile and "user-friendly"

software, the large amount of data is more easily handled. However, data reduction of a GC/MS chromatogram still requires substantially more time than for a GC/ECD chromatogram. In addition, the sensitivity of GC/MS has improved.



## d. Field-Portable Gas Chromatography Instrumentation

Gas chromatography may be used for analysis of samples in the field. Gas chromatography is a well-established laboratory technique, and portable instruments with electron capture detectors are available (Spittler 1983, Colby et al. 1983, Picker and Colby 1984). A field-portable GC/ECD was used to obtain rapid measurements of PCBs in sediment and soil (Spittler 1983). The sample preparation consisted of a single solvent extraction. The PCBs were eluted from the GC within 9 min. In a 6-h period, 40 soils and 10 QC samples were analyzed, with concentrations ranging from 0.2 to 24,000 ppm. The use of field analysis permits real-time decisions in a cleanup operation and reduces the need for either return visits to a site.

Mobile mass spectrometers are also available. An atmospheric pressure chemical ionization mass spectrometer, marketed by SCIEX, has been mounted in a van and used for in situ analyses of soil and clay (Lovett et al. 1983). The instrument has apparently been used for field determination of PCBs in a variety of emergency response situations, including hazardous waste site cleanups. Other, more conventional mass spectrometers, should also be amenable to use in the field.

## Thin-Layer Chromatography (TLC)

Thin-layer chromatography is a well-established analytical technique which has been used for the determination of PCBs for many years. Since the publication of a TLC method for PCBs by Mulhern (Mulhern 1968, Mulhern et al. 1971), several researchers have used TLC to measure PCBs in various matrices. Methods have been reported by Willis and Addison (1972) for the analysis of Aroclor mixtures, by Piechalak (1984) for the analysis of soils, and by Stahr (1984) for the analysis of PCB containing oils. Even with a densitometer to measure the intensity of the spots, TLC is not generally considered quantitative. Order-of-magnitude estimates of the concentration are certainly obtainable, but the precision and accuracy probably do not approach that of the gas chromatographic methods.

A spill site sample extract will probably need to be cleaned up before TLC analysis. Levine et al. (1983) have published a comparison of various cleanup procedures. Stahr (1984) has compared the Levine sulfuric acid cleanup to a SepPak®  $C_{18}$  cleanup method.

Different TLC techniques have been used to improve the sensitivity and selectivity of the method. Several researchers have reported that the use of reverse-phase TLC (C<sub>18</sub>-bonded phase) achieves a better separation of PCBs from interferences (DeVos and Peet 1971, DeVos 1972, Stalling and Huckins 1973, Brinkman et al. 1976). Koch (1979) has reported an order of magnitude improvement in the PCB limit of detection through use of circular

TLC. The two most common methods of visualization are fluorescence (Kan et al. 1973, Ueta et al. 1974) and reaction with  $AgNO_3$  followed by UV irradiation (DeVos and Peet 1971, DeVos 1972, Kawabata 1974, Stahr 1984).

No direct comparison of the performance of TLC with other techniques for analysis of samples from spill sites has been made. Two studies (Bush et al. 1975, Collins et al. 1972) compared TLC and GC/ECD. In both studies, the PCB values obtained were comparable. However, the study by Bush et al. indicated that the TLC results were generally lower than GC/ECD.

## 3. Total Organic Halide Analyses

Total organic halide analysis can be used to estimate PCB concentrations for guiding field work, but is not appropriate for verification or enforcement analyses. A total organic halide analysis indicates the presence of chlorine and sometimes the other halogens. Many of the techniques also detect inorganic chlorides such as sodium chloride. The reduction of organochlorine to free chloride ion with metallic sodium can be used for PCB analysis. The free chloride ions can be then detected colorimetrically (Chlor-Noil®) or by a chloride ion-specific electrode (McGraw-Edison). The performance of these kits has not been tested with any matrix other than mineral oil. X-ray fluorescence (XRF) has also been studied as a PCB screening technique (McQuade 1982, Schwalb and Marquez 1982).

## D. <u>Selection of Appropriate Methods</u>

#### 1. Criteria for Selection

The primary criterion for an enforcement method is that the data be highly reliable (i.e., they are legally defensible). This does not necessarily imply that the most exotic, state-of-the-art methods be employed; rather that the methods have a sound scientific basis and validation data to support their use. Many other criteria also enter into selection of a method, including accuracy, precision, reproducibility, comparability, consistency across matrices, availability, and cost.

For PCB spills, it is assumed that the spills will be relatively fresh and therefore that PCB mixtures will generally resemble those in commercial products (i.e., Aroclor®). It is further assumed that, for most of the matrices likely to be encountered, the levels of interferences will be relatively low.

## 2. Selection of Instrumental Techniques

Based upon the above criteria and assumptions, either GC/ECD or GC/MS should provide suitable data. Since GC/ECD is included in more standard methods and since the technique is more widely used, it appears to be the technique of choice. The primary methods recommended below are all based on GC/ECD instrumental analysis. Some of the secondary and confirmatory techniques are based on GC/EIMS.

#### 3. Selection of Methods

Ideally, a standard method would be available for each matrix likely to be encountered in a PCB spill. The matrices of concern include solids (soil, sand, sediment, bricks, asphalt, wood, etc.), water, oil, surface wipes, and vegetation. The methods for these matrices are summarized in Table 22 and discussed in detail below. A primary recommended method is given and should be used in most spill instances. The secondary method may be useful for confirmatory analyses, or where the situation (e.g., high level of interferences) indicates that the primary method is not applicable. The methods used must be documented or referenced.

## a. Solids (Soil, Sand, Sediment, Bricks, Asphalt, Wood, Etc.)

EPA Method 8080 from SW-846 (USEPA 1982e) is the primary recommended method. The secondary methods, Method 8250 and Method 8270, are GC/MS analogs. Method 8080 entails an acetone/hexane (1:1) extraction, a Florisil column chromatographic cleanup, and a GC/ECD instrumental determination. A total area quantitation versus Aroclor standards is specified. No qualitative criteria are supplied. A detection limit of 1  $\mu$ g/g is prescribed. No validation data are available.

Bulk samples (bricks, asphalt, wood, etc.) should be readily extractable using a Soxhlet extractor according to EPA Method 8080 (USEPA 1982e). The sample must be crushed and subsampled to ensure proper solvent contact.

#### b. Water

EPA Method 608 (USEPA 1984e) is recommended as the primary method. This is one of the "priority pollutant" methods and involves extraction of water samples with dichloromethane. An optional Florisil column chromatographic cleanup and also an optional sulfur removal are given. Samples are analyzed by GC/ECD and quantitated against the total area of Aroclor standards. No qualitative criteria are given. This method has been extensively validated and complex recovery and precision equations are given in the method for seven Aroclor mixtures. The average recovery is about 86% and average overall precision about  $\pm$  26%. The average recovery and precision for the more common Aroclors (1242, 1254, and 1260) are about 78% and  $\pm$  26%, respectively. Detection limits are not given in the current version (USEPA 1984a), although they were listed as between 0.04 and 0.15  $\mu g/L$  for the seven Aroclor mixtures listed as priority pollutants in the method validation study (Millar et al. 1984).

#### c. Oils

Spilled oil samples should be analyzed according to an EPA method (Bellar and Lichtenberg 1981). The method is written for transformer fluids and waste oils, but should also be applicable to other similar oils such as capacitor fluids. In this method, samples are diluted by an appropriate factor (e.g., 1:1000). Six optional cleanup techniques are given.

Table 22. Summary of Recommended Analytical Methods

Matrix	Primary method (GC/ECD) Designation Refere	d (GC/ECD) Reference		Secondary method	
			uesignation	GC detector	Reference
Solids	8080	USEPA 1982e	8250, 8270	V 30	4 4 4 L U L
Water	809	USEPA 1984a	625	) 30	USERA 1982e
Oil	"0;1"	USEPA 1981a;	"0;1"	2 . 2	USEPA 1984b
		Bellar and Lichtenberg,		Ĉ	USEPA 1981 <sub>a;</sub> Bellar and
		1981			Lichtenberg,
Surface Wipes	Hexane extrac- tion/608	None	Hexane extrac-	MS	None
Vegetation	A0AC (29)	A0AC 1980a	(20 /10 C		
			allow	None	None

The sample may be analyzed by GC/ECD as the primary method. Secondary instrumental choices, also presented in the method, are GC/HECD, GC/MS, and capillary GC/MS. PCBs are quantitated by either total areas or the Webb-McCall (1973) method. No qualitative criteria are given. QC criteria are given. A detection limit of 1 mg/kg is stated, although it is highly dependent on the amount of dilution required. An interlaboratory validation study (Sonchik and Ronan 1984) indicated 81 to 126% recoveries for different PCB mixtures, with an average of 97% for Aroclors 1242, 1254, and 1260, as measured by ECD. The overall method precision ranged from  $\pm$  11 to  $\pm$  55%, with an average of  $\pm$  12% for Aroclors 1242, 1254, and 1260. The method validation statistics were presented in more detail as regression equations.

#### d. Surface Wipes

No standard method is available for analysis of PCBs collected on surface wipes. However, since this matrix should be relatively clean and easily extractable, a simple hexane extraction should be sufficient. Samples should be analyzed according to EPA Method 608 (USEPA 1984a), except for Section 10.1 through 10.3. In lieu of these sections, the sample should be extracted three times with 25 to 50 mL of hexane. The sample can be extracted by shaking for at least 1 min per extraction in the wide-mouthed jar used for sample storage. Note that the rinses should be with hexane so that solvent exchange from methylene chloride to hexane (Section 10.7) is not necessary.

#### e. <u>Vegetation</u>

The AOAC (1980a) procedure for food is recommended for analysis of vegetation (leaves, vegetables, etc.). This method involves extraction of a macerated sample with acetonitrile. The acetonitrile is diluted with water and the PCBs extracted into petroleum ether. The concentrated extract is cleaned up by Florisil column chromatography by elution with a mixture of ethyl ether and petroleum ether. The sample is analyzed by GC/ECD with quantitation by total areas or individual peak heights as compared to Aroclor standards. No qualitative criteria are given. Validation studies with chicken fat and fish (Sawyer 1973) are not relevant to the types of matrices to be encountered in PCB spills.

#### 4. Implementation of Methods

Each laboratory is responsible for generating reliable data. The first step is preparation of an in-house protocol. This detailed "cookbook" is based on methods cited above, but specifies which options must be followed and provides more detail in the conduct of the techniques. It is essential that a written protocol be prepared for auditing purposes.

Each laboratory is responsible for generating validation data to demonstrate the performance of the method in the laboratory. This can be done before processing of samples; however, it is often impractical. Validation of method performance (replicates, spikes, QC samples, etc.) while analyzing field samples is acceptable.

Changes in the above methods are acceptable, provided the changes are documented and also provided that they do not affect performance. Some minor changes (e.g., substitution of hexane for petroleum ether) do not generally require validation. More significant changes (e.g., substitution of a HECD for ECD) will require documentation of equivalent performance.

## E. Quality Assurance

Quality assurance must be applied throughout the entire monitoring program including the sample planning and collection phase, the laboratory analysis phase, and the data processing and interpretation phase.

Each participating EPA or EPA contract laboratory must develop a quality assurance plan (QAP) according to EPA guidelines (USEPA 1980). Additional guidance is also available (USEPA 1983). The quality assurance plan must be submitted to the regional QA officer or other appropriate QA official for approval prior to analysis of samples.

## 1. Quality Assurance Plan

The elements of a QAP (U.S. EPA, 1980) include:

Title page Table of contents Project description Project organization and responsibility OA objectives for measurement data in terms of precision, accuracy, completeness, representativeness, and comparability Sampling procedures Sample tracking and traceability Calibration procedures and frequency Analytical procedures Data reduction, validation and reporting Internal quality control checks Performance and system audits Preventive maintenance Specific routine procedures used to assess data precision, accuracy and completeness Corrective action Quality assurance reports to management

# 2. Quality Control

Each laboratory that uses this method must operate a formal quality control (QC) program. The minimum requirements of this program consist of an initial and continuing demonstration of acceptable laboratory performance by the analysis of check samples, spiked blanks, and field blanks. The laboratory must maintain performance records which define the quality of data that are generated.

The exact quality control measures will depend on the laboratory, type and number of samples, and client requirements. The QC measures should be stipulated in the QA Plan. The QC measures discussed below are given for example only. Laboratories must decide on which of the measures below, or additional measures, will be required for each situation.

### a. Protocols

Virtually all of the available PCB methods contain numerous options and general instructions. Effective implementation by a laboratory requires the preparation of a detailed analysis protocol which may be followed unambiguously in the laboratory. This document should contain working instructions for all steps of the analysis. This document also forms the basis for conducting an audit.

# b. Certification and Performance Checks

Prior to the analysis of samples, the laboratory must define its routine performance. At a minimum, this must include demonstration of acceptable response factor precision with at least three replicate analyses of a calibration solution; and analysis of a blind QC check sample (e.g., the response factor calibration solution at unknown concentration submitted by an independent QA officer). Acceptable criteria for the precision and the accuracy of the QC check sample analysis must be presented in the QA plan.

Ongoing performance checks should include periodic repetition of the initial demonstration or more elaborate measures. More elaborate measures may include control charts and analysis of QA check samples containing unknown PCBs, and possibly with matrix interferences.

#### c. Procedural QC

The various steps of the analytical procedure should have quality control measures. These include, but are not limited to, the following:

Instrumental Performance: Instrumental performance criteria and a system for routinely monitoring the performance should be set out in the QA Plan. Corrective action for when performance does not meet the criteria should also be stipulated.

Qualitative Identification: Any questionable results should be confirmed by a second analytical method. A least 10% of the identifications, as well as any questionable results, should be confirmed by a second analyst.

Quantitation: At least 10% of all calculations must be checked. The results should be manually checked after any changes in computer quantitation routines.

### d. Sample QC

Each sample and each sample set must have QC measures applied to it to establish the data quality for each analysis result. The following should be considered when preparing the QA plan:

Field Blanks: Field blanks are analyzed to demonstrate that the sample collection equipment has not been contaminated. A field blank may be generated by using the sampling equipment to collect a blank sample (e.g., using the water sampling equipment to sample laboratory reagent grade water) or by extracting the sampling equipment (e.g., extracting a sheet of filter paper from the lot used to collect wipe samples or rinsing the soil sampling apparatus into the sample jar). A field blank must be collected and analyzed for each type of sample collected.

Laboratory Reagent Blanks: These blanks are generated in the laboratory and are analyzed to assess contamination of glassware, reagents, etc., in the laboratory. Generally, a reagent blank is processed through the entire analysis process. Although in special circumstances, additional reagent blanks may be generated which are processed through only part of the procedure to isolate sources of contamination. At least one laboratory reagent blank must be generated and analyzed for each type of sample analyzed.

Check Samples: These samples contain known concentrations of PCBs in the sample matrix. They are analyzed along with field samples to demonstrate the method performance: The PCB concentrations may be known to the analyst.

Blind Check Samples: These samples are the same as the check samples discussed above, except the PCB concentration is not known to the analyst.

Replicate Samples: One sample from each batch of 20 or fewer will be analyzed in triplicate. The sample is divided into three replicate subsamples and all these subsamples carried through the analytical procedure, blind to the analyst. The results of these analyses must be comparable within the limits required for spiked samples.

Spiked Samples: The sensitivity and reproducibility must be demonstrated for any method used to report verification data. This can be done by analyzing spiked blanks near the required detection limit. To demonstrate the ability of the method to reproducibly detect the spiked sample, one or more spiked samples should be analyzed in at least triplicate for each group of 20 or fewer samples within each sample type collected. Samples will

be spiked with a PCB mixture similar to that spilled (e.g., Aroclor 1260). Example concentrations are:



Matrix

Spike Level

Soil, etc.

 $10 \mu g/g (10 ppm)$ 

Water

100 µg/L (100 ppb))

Wipes

100  $\mu$ g/wipe (100  $\mu$ g/100 cm<sup>2</sup>)

Quantitative techniques must detect the spike level within ±30% for all spiked samples.

### e. Sample Custody

As part of the Quality Assurance Plan, the chain-of-custody protocol must be described. A chain-of-custody provides defensible proof of the sample and data integrity. The less rigorous sample traceability documentation merely provides a record of when operations were performed and by whom. Sample traceability is not acceptable for enforcement activities.

Chain-of-custody is required for analyses which may result in legal proceedings and where the data may be subject to legal scrutiny. Chain-of-custody provides conclusive written proof that samples are taken, transferred, prepared, and analyzed in an unbroken line as a means to maintain. sample integrity. A sample is in custody if:

- It is in the possession of an authorized individual;
- It is in the field of vision of an authorized individual:
- It is in a designated secure area; or
- It has been placed in a locked container by an authorized individual.

A typical chain-of-custody protocol contains the following elements:

- Unique sample identification numbers.
- Records of sample container preparation and integrity prior to sampling.
- Records of the sample collection such as:

the Property Current Assessment Specific location of sampling. THE CONTRACT OF STREET OF

- Date of collection.
- Exact time of collection.
- Type of sample taken (e.g., air, water, soil).
- Initialing each entry.
- Entering pertinent information on chain-of-custody record.
- Maintaining the samples in one's possession or under lock and key.
- Transporting or shipping the samples to the analysis laboratory.
- Filling out the chain-of-custody records.
- The chain-of-custody records must accompany the samples.
- 4. Unbroken custody during shipping. Complete shipping records must be retained; samples must be shipped in locked or sealed (evidence tape) containers.
- 5. Laboratory chain-of-custody procedures consist of:
  - Receiving the samples.
  - Checking each sample for tampering.
  - Checking each sample against the chain-of-custody records.
  - Checking each sample and noting its condition.
  - Assigning a sample custodian who will be responsible for maintaining chain-of-custody.
  - Maintaining the sign-offs for every transfer of each sample on the chain-of-custody record.
  - Ensuring that all manipulations of the sample are duly recorded in a laboratory notebook along with sample number and date. These manipulations will be verified by the program manager or a designee.

# F. Documentation and Records

Each laboratory is responsible for maintaining complete records of the analysis. A detailed documentation plan should be prepared as part of

the QAP. Laboratory notebooks should be used for handwritten records. Digital or other GC/MS data must be archived on magnetic tape, disk, or a similar device. Hard copy printouts may also be kept if desired. Hard copy analog data from strip chart recorders must be archived. QA records should also be retained.

The documentation must completely describe how the analysis was performed. Any variances from a standard protocol must be noted and fully described. Where a procedure lists options (e.g., sample cleanup), the option used and specifics (solvent volumes, digestion times, etc.) must be stated.

The remaining samples and extracts should be archived for at least 2 months or until the analysis report is approved by the client organization (whichever is longer) and then disposed unless other arrangements are made. The magnetic disks or tapes, hard copy chromatograms, hard copy spectra, quantitation reports, work sheets, etc., must be archived for at least 3 years. All calculations used to determine final concentrations must be documented. An example of each type of calculation should be submitted with each verification spot.

30 BB:

# G. Reporting Results

Results of analysis will normally be reported as follows:

Matrix	Reporting Units
Soil, etc.	μg PCB/g of sample (ppm)
Water	mg PCB/L of sample (pom)
Surfaces (wipes)	μg PCB/wipe (μg PCB/100 cm²)

In some cases, the results are to be reported by homolog. In this case, ll values are reported per sample: one each for the 10 homologs and one for the total. Some TSCA analyses require reporting the results in terms of resolvable gas chromatographic peak (U.S. EPA, 1982c, 1984e). In these cases, the number of results reported equals the number of peaks observed on the chromatogram. These analyses are generally associated with a regulatory cutoff (e.g., 2 µg/g per resolvable chromatographic peak (U.S. EPA, 1982c, 1984). In these cases it may be sufficient, depending on the client organization's request, to report only those peaks which are above the regulatory cutoff.

Even if an Aroclor is used as the quantitation standard, the results are never to be reported as "ug Arocloro/g sample." TSCA regulates all PCBs, not merely a specific commercial mixture.

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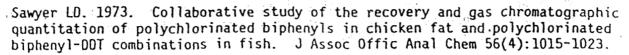
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15. SUPPLEMENTARY NOTES

The EPA work assignment managers are Daniel T. Heggem and Richard A. Levy The EPA project officers are Joseph J. Breen and Joseph S. Carra

This report, intended primarily for EPA enforcement personnel, outlines specific sampling and analysis methods to determine compliance with EPA policy on the cleanup of PCB spills. The sampling and analysis methods can be used to determine the residual levels of PCBs at a spill site following the completion of cleanup activities Although the methodologies outlined in this document are applicable to PCB spills in general, specific incidents may require special efforts beyond the scope of this report.

A sampling design is proposed for use by EPA enforcement staff in detecting residual PCB contamination above a designated limit after a spill site has been cleaned. The proposed design involves sampling on a hexagonal grid which is centered on the cleanup area and extends just beyond its boundaries. Guidance is provided for centering the design on the spill site, for staking out the sampling locations, and for taking possible obstacles into account. Compositing strategies, in which several samples are pooled and analyzed together, are recommended for each of the three proposed designs. Sampling and analysis techniques are described for PCB-contaminated solids (soil, sediment, etc.), water, oils, surface wipes, and vegetation. Quality assurance (QA) must be applied throughout the entire monitoring program. Quality control (QC) measures, including protocols, certification and performance checks, procedural QC, sample QC, and sample custody as appropriate, should be stipulated in a QA plan.

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